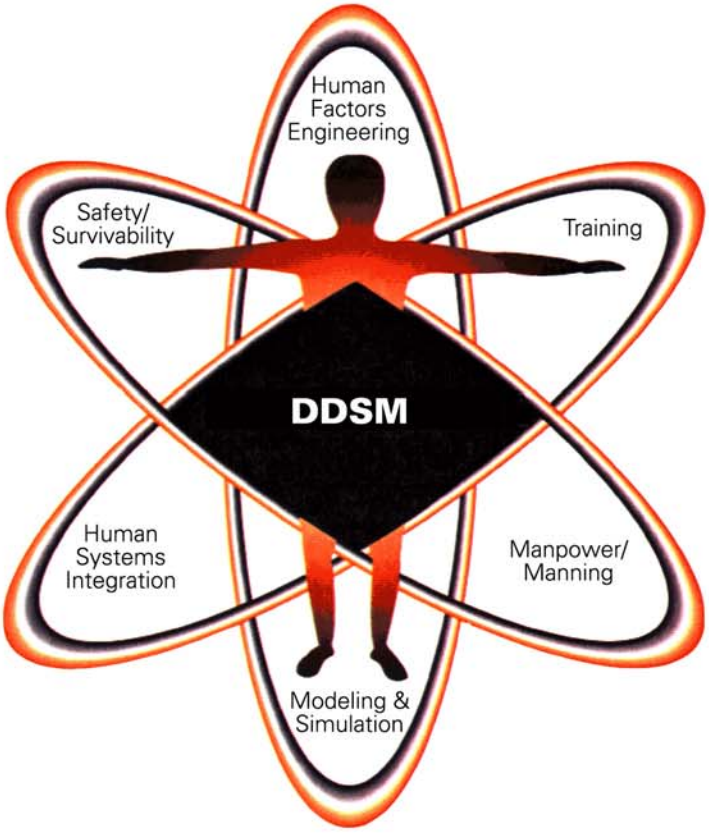
MATRIS®

Directory of Design Support Methods



Defense Technical Information Center
MATRIS® Office, DTIC-AM
NAS North Island, Bldg. 1482, Box 357011
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14. ABSTRACT

This Directory contains references to human systems integration (HSI) design and interface tools, techniques, databases, guides and standardization documents. HSI encompasses human factors, human performance, training, manpower and personnel systems analysis and design. Contributors include: U.S. Department of Defense (DoD), Federal Aviation Administration (FAA), National Aeronautical and Space Administration (NASA), other U.S. government agencies, NATO countries, academia, and private industry.

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DIRECTORY OF DESIGN SUPPORT METHODS

AUGUST 2005

MATRIS Office
Defense Information Systems Agency
Defense Technical Information Center
NAS North Island, Box 357011
SAN DIEGO, CA 92135-7011
PHONE: (619) 545-7384 ; DSN 735-7384
WEBSITE: http://www.dtic.mil/matris/

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PREFACE

This Directory of Design Support Methods (DDSM) is a revision of the original report developed under the auspices of the Designing for the User Subgroup of the Department of Defense Human Factors Engineering Technical Advisory Group (DoD HFE TAG). The original document, and its associated database, was expanded in 1994 to include the NATO Panel 8, Research Study Group 21 LIVEWARE database. At that time the original human factors focus was broadened to include all human systems.

The DDSM provides an annotated directory of human systems integration (HSI) design support tools and techniques that have been developed by the DoD, NASA, FAA, NATO countries, academia, and private industry. It contains references to human interface design tools, training design tools, human performance analysis, analytic techniques, simulation software, databases, handbooks, guides, standardization documents. It serves as a resource for applying HSI principles, to be used by anyone who is designing a system or evaluating a system design.

The format for each entry in the DDSM offers the name of the method, the sponsor, a current point of contact, and a full description, including general overview, appropriate uses, input requirements, processing procedures, and output product uses. The format also includes references, alternative approaches, availability status, and information on how to obtain the product.

The DDSM contains references to design tools or techniques that are currently available or under development. New records continue to be added as new human systems tools and techniques are developed. The MATRIS Office periodically updates and republishes a hard copy of the DDSM to reflect the current information in the database. Records of products or processes that are no longer in use are archived and also are listed on the DDSM web site.

The most current version of the DDSM, updated continuously on the web, may be found at the Website:

http://www.dtic.mil/matris/ddsm/

To submit records for inclusion in the database and in future editions of the DDSM, please contact the MATRIS Office, or use the DDSM Submission Form found on the web site.

MATRIS Office, Defense Technical Information Center
http://www.dtic.mil/matris/

DOD STANDARDIZATION DOCUMENTS - GENERAL INFORMATION

OVERVIEW:
This section contains records of technical standardization documents covering human systems integration (HSI). Many documents (not included in this section) are titled as standards, but provide professional standards, administrative standards, policy statements and similar non- technical information. On the other hand, many documents provide technical guidance and requirements in the HSI area, and are written as standards, but are titled as "guidelines," "preferred practices," "handbooks," and the like. Accordingly, documents are not included in this section merely because they are titled or numerically designated as standards or related documents.

SELECTION OF LISTINGS:
Documents are not included solely because their contents are expressed as standards. To qualify for inclusion in this section, a document must:

- have been developed on a consensus basis
- have undergone some type of formal coordination
- have followed defined rules of due process for disposition of review comments
- have been developed in an open, transparent manner
- have been developed by a government or non-government standards body
- follow a specified format published by that body
- consist of technical (rather than professional or administrative) provisions
- present requirements and/or guidelines (rather than tutorials)
- provide human factors design and/or programmatic requirements and/or guidelines
- express provisions that can be measured or otherwise evaluated

ORDERING INFORMATION:
Policy DoD Single Stock Point (DoDSSP) customers in the federal sector (other than DoD), State, municipal, and foreign customers, and all commercial customers in the private sector, may purchase DoDSSP products in any quantity desired. Explanation, pricing and ordering can be done using the DoDSSP web site: http://www.dodssp.daps.mil/

DoD Customers are Service-funded to receive paper-format document initials and subscriptions on an automatic "push" basis. DoD customers are also Service-funded to receive single-copy orders for individual paper-format documents. Individual ASSIST online subscriptions are Service-funded for DoD customers, as well. DoD requests for bulk quantities must be referred to DAPS code: DPM-9, or call the DoDSSP Special Assistance Desk (215-697-2179). MIL-STDs are also available free of charge on the Defense Technical Information Center (DTIC) Public STINET and, for DTIC registered users, Private STINET. Public STINET URL: http://stinet.dtic.mil/

Non-Government Standards (NGS) All NGSs cited by Human Factors Standardization documents have been adopted and are available from the DoDSSP to DoD activities only. All other requesters must obtain copies from the releasing organization. Non-DoD requesters of an adopted NGS may use the ordering address appearing in the applicable adoption notice, or the ordering address appearing in the "Applicable Documents" section of the citing document.

DATABASES/INFORMATION CENTERS

Title: Anthropometric Data Sets

Overall Category: Database/Information Center
Updated: July 2004

Owner/Sponsor Organization: Human Systems IAC
http://iac.dtic.mil/hsiac/

Point of Contact Information:

Dr. Joe W. McDaniel
937-255-4842 DSN: 785-4842 FAX: 937-255-4823
joe.mcdaniel@wpafb.af.mil

Product Specific Web Site:
http://iac.dtic.mil/hsiac/Anthro_Sets.htm

General Overview:
In 1994, the Crew System Ergonomics Information Analysis Center (CSERIAC), now the Human Systems Information Analysis Center (HSIAC), acquired a large repository of traditional two-dimensional anthropometric data from the Computerized Anthropometric Research and Design (CARD) Laboratory of the Paul M. Fitts Human Engineering Division of the Armstrong Laboratory at Wright-Patterson AFB, OH. This repository of data originally consisted of over fifty U.S. and international anthropometric surveys on both military and civilian populations. These surveys represent more than forty-five years of research, and account for hundreds of measurements on thousands of individuals.

Since these surveys were conducted by many individuals and organizations over a long period of time, the measuring techniques and terminology were not always consistent from survey to survey. For example, "stomach depth" in one survey may have been termed "abdominal depth" in another, and waist circumference may have been measured at the level of the navel in one survey, and at the level of the subject's waist's natural indentation in the next survey. To eliminate these inconsistencies and the confusion they create, HSIAC performed an exhaustive evaluation of all the surveys for which the documentation could be obtained, determined the similarities and differences between the surveys and the measurements, and developed a standardized coding scheme to be applied to the measurements across all of the surveys.

Over fifty U.S. and international anthropometric surveys on both military and civilian populations have been evaluated and are now available for general use. Each survey has a different number of subjects [the largest having over 8,000 subjects] and different numbers of measures on each subject [the largest being 186 measures]. Each survey contains the original ASCII dataset file and a text file that describes the survey, provides the documentation reference, and lists the specific variables that are included in the survey. The ASCII data can be directly imported into any statistical software package or spreadsheets on a personal computer for analysis.

A manual is also provided which contains the standardized measurement definitions, a glossary of landmark definitions, a complete list of the standardized measurements and their codes, and the information needed to order the documentation for the surveys.

This data can be used for comparison of actual vs. needed design body dimensions. This tool is applicable for use in designing any system in which a human interacts. For example, workspace design, Computer-Aided Design (CAD) man models, furniture design, and tool design.

Equipment/Software Required:
Personal computer and a statistical analysis software package or spreadsheet.

Input/Output/Processing:

Data File Description. Provides a detailed description of the survey, a list of the measurements in the survey, a description of the raw ASCII data file format, the associated reference document, and instructions on how to order the document. Raw ASCII Data File. The data can be imported into most statistical software packages or spread sheets for analysis.

The analyst using this data should have an understanding of human factors engineering, anthropometry, and statistical analysis. The analyst needs to select the appropriate body dimensions needed for the design and conduct of a statistical analysis on these dimensions. These results are then summarized and applied to the system design.

Data analysis results printout provided by the statistical package.

Documentation:
Manual provided. Catalog of Anthropometric Measurement Definitions can also be downloaded.

Unger, Rebecca A. (1996), The CSERIAC Anthropometric Data Files, Gateway, Vol. VII (2), p. 7, CSERIAC, Wright-Patterson AFB, OH. http://iac.dtic.mil/hsiac/GW-docs/gw_vii_2.pdf

Alternative/Comparable Approaches:
Computerized Anthropometric Research and Design (CARD) Lab 3-D data.

Stage of Development:
Ready for distribution.

Date Current Version Released:
Over fifty U.S. and international anthropometric surveys on both military and civilian populations from 1946 – 1990.

How To Acquire:
Data sets can be downloaded free from http://iac.dtic.mil/hsiac/Anthro_Sets.htm

Title: Army Risk Management Information System (RMIS)

Overall Category: Database/Information Center
Updated: August 2004

Owner/Sponsor Organization: Army Safety Center
https://rmis.army.mil/ (password version)
https://safety.army.mil/ (open site)

Point of Contact Information:

J.T. Coleman
334-255-2919 DSN: 558-2919 FAX: 558-9528
james.coleman@safetycenter.army.mil

Product Specific Web Site:
https://rmis.army.mil/

General Overview:
To do their jobs effectively, designers, trainers, researchers, safety engineers, and all others involved in MANPRINT/HSI activities must have direct knowledge of the problems that "users" have during the operational use of Army systems. This database provides such critical information on all Army systems (air and ground) to help define and prioritize warfighting issues/needs.

RMIS contains many years of data on accidents reported by field units from all over the world. Safety regulations and accident directives are also accessible. Two examples of its capabilities are: 1) it can be queried to define accident populations/profiles by age, grade, MOS, height, weight, etc.; and 2) it can identify where the top problem areas are by dollar loss, fatalities, or frequencies of occurrence.

RMIS provides support for DoD Human System Integration programs and Army MANPRINT programs during all phases of system development and operation. This includes defining issues, determining needs and priorities, and assessing system design to determine if identified issues were actually resolved, or if new human interface problems have arisen. Accident findings are in "field language", and must be translated into human performance issues.

Output is used for definition and prioritization of critical human factors warfighting issues and needs. Users of this information include designers, trainers, researchers, safety professionals, manpower and personnel experts, and advanced technologists. MANPRINT Joint work groups, Science and Technology review boards, System Safety work groups, and Training and Simulation work groups are also users.

Equipment/Software Required:
RMIS requires a personal computer with modem and a voice-grade telephone line.

Input/Output/Processing:
Follow user's guide to menus.

Information displayed on a computer screen, printouts, and "down load" data.

Stage of Development:
RMIS is fully operable, 24 hours per day. Accident "summaries' are available as part of standard information. Access to specific accident findings on human performance must be requested separately.

Date Current Version Released:
1 October 1998

Comments:
The information obtained from the protected site is not releasable, except for purposes of government accident prevention. It may be used within DoD for safety purposes, and may not be used for any adverse administrative or disciplinary purposes (AR 385-40). The information may be released on a need-to-know basis only. It cannot be released without coordinating with the U.S. Army Safety Center.

How To Acquire:
Password can be obtained by logging onto https://safety.army.mil and following the log-on procedures under the AKO password box.

Title: Biodynamics Data Bank (BDB)

Overall Category: Database/Information Center
Updated: August 2004

Owner/Sponsor Organization: Air Force Research Laboratory (AFRL)
http://www.he.afrl.af.mil/

Point of Contact Information:

Mr. John Buhrman
937-255-3121 DSN: 785-3121 FAX: 937-255-3343
john.buhrman@wpafb.af.mil

Product Specific Web Site:
http://www.biodyn.wpafb.af.mil/

General Overview:
The Biodynamics Data Bank (BDB) was established in 1984 by a team of researchers at the Air Force Research Laboratory (AFRL) with the purpose of organizing and archiving thousands of impact acceleration tests conducted over the past several decades. It has evolved into a dynamic Windows-based system consisting of an SQL Server database and Web user interface with full search capabilities. The back-end SQL Server database stores and manages the data and the front-end web user interface searches, calculates, and displays the data.

The BDB contains data from over 10,000 impact acceleration tests conducted in-house at AFRL with both human subjects and instrumented manikins. The tests were conducted on man-rated impact test facilities capable of providing a wide range of acceleration pulses for simulation of both ejection and automotive impacts. The facilities include the Vertical Deceleration Tower (VDT), Vertical Accelerator (VA), Vertical Impact Device (VID), Horizontal Impulse Accelerator (HIA), and Horizontal Decelerator (HD). These tests have been a primary source of biodynamic response data for engineers at AFRL as well as other research agencies and universities, and have led to improvements in the areas of ejection injury criteria, restraint system safety, and impact response modeling.

The primary access to the BDB is through its web interface. A user management system requires a basic user registration for full access. The interface offers a comprehensive capability for data display, visualization, search, and analysis. Search tools are designed to let users obtain information and data easily and quickly. Data cleared for public release are deployed to the Wright Patterson AFB public server and are accessible through the Internet.

Data from the BDB have been used extensively by researchers in the areas of automotive crash protection and aircraft ejection seat safety. The data have been used in the evaluation of ejection seat and restraint system design, and in the establishment of safe parameters for human response to impact variables such as helmet weight, seat back angle, and multi-axial impact exposure. Human response data from the BDB have been employed in the development and validation of biodynamic models such as the Articulated Total Body (ATB) model. The ATB is used to predict biodynamic responses of crewmembers and to evaluate injuries associated with diverse aircraft ejection events.

Equipment/Software Required:
Personal computer with Windows operating system and MS Explorer or Netscape browser.

Input/Output/Processing:
The user can browse the database contents or conduct searches based on specified area of research, test facility, test parameters, or subject anthropometry. Searches of related references can also be conducted based on author, title, or keyword. The data can be displayed either in tabular format or the user can choose to display the data

graphically using a built-in plotting routine. The data can also be downloaded for use with any standard statistical package. The data are displayed in MS Excel spreadsheets with the variable of interest (acceleration, force, displacement, etc.) being displayed as a function of time (milliseconds). It is recommended that the user select test data based on the test facility most appropriate to the area of interest (e.g. automotive research typically centers on the HIA while most ejection research would utilize data from the VDT).

Documentation:
Buhrman J.R., Plaga J.A, Cheng H., and Mosher S.E. The AFRL Biodynamics Data Bank on the Web: A repository of Human Impact Acceleration Response Data. Proceedings of the 39th Annual SAFE Symposium, Oct 2001.

Cheng H. and Buhrman J.R. Development of the AFRL Biodynamics Data Bank and Web User Interface. SAE Technical Paper 2000-01-0162, SAE 2000 World Congress, Detroit, Michigan, 2000.

Buhrman J.R. The AFRL Biodynamics Data Bank and Modeling Applications, Report No. RTO-MP-20, In: Models for Aircrew Safety Assessment: Uses, Limitations, and Requirements, RTO Meeting Proceedings, Dayton, Ohio, 1998.

Alternative/Comparable Approaches:
National Crash Survival Data Bank (NCSDB) at University of New Orleans (http://www.uno.edu/)– not as accessible or extensive as BDB.

Stage of Development:
Ready for distribution.

Date Current Version Released:
The BDB was transferred to the Internet on January 2001, and is continuously updated.

How To Acquire:
Registration is required for full access to the BDB. There is no charge and a registration form is provided on the home page. All data has been cleared for public release and can be downloaded by the user in limited amounts.

Title: Computer-Aided Systems Human Engineering (CASHE)

Overall Category: Database/Information Center
Update: July 2004

Owner/Sponsor Organization: Human Systems Information Analysis Center
http://iac.dtic.mil/hsiac/

Point of Contact Information:

Dr. Joe W. McDaniel
937-255-4842 DSN: 785-4842 FAX: 937-255-4823
joe.mcdaniel@wpafb.af.mil

Product Specific Web Site:
http://iac.dtic.mil/hsiac/Products.htm#CASHE

General Overview:
CASHE is a human factors information test bench. Distributed on CD-ROM, this interactive, hypertext system supports four primary functions:

1) retrieval of information from and navigation within the information base, consisting of the complete Engineering Data Compendium, MIL-STD-1472D, and user-created files;

2) annotation of the information base to augment its personal meaning and value (annotations include attaching notes to information objects, linking together objects, marking objects for subsequent recall, and developing personal indices of terms, and then linking these terms to objects in the information base);

3) experiential understanding of human perception and performance phenomena via the integrated Perception and Performance Prototyper (P3) (browsing of the text improves recognition of the material in other contexts, and the understanding of the factors that control their expression); and

4) manipulation and transportation of quantitative relationships contained in the information base or brought in from external sources.

Both quantitative and graphical manipulations are supported. As with experiencing phenomena first-hand, this functionality is expected to promote recognition and understanding.

CASHE will allow: 1) improved access to human performance data via the electronic databases; 2) improved understanding of that data via interactive data graphs and data simulations; and 3) improved application of the information via the prototyping capabilities of the P3. The goal of CASHE is to integrate that information with engineering design efforts in order to achieve a match between operator characteristics and specifications for all types of military and industrial systems.

The output of CASHE can be used to incorporate human engineering principles and data into the system design process**.**

Equipment/Software Required:
The minimum required equipment is Apple MacIntosh II, with at least a 13" monochrome display, 8 MB memory, 10 MB of available hard drive space, and a CD-ROM drive. The preferred equipment is MacIntosh PowerPC with at least a 13" color display, 8 MB of memory, 27 MB of available hard drive space, and a CD-ROM drive.

Input/Output/Processing:

The system is self-contained, but other data may be imported into CASHE, allowing for user-supplied data to be compared with the on-line reference data.

Multiple methods exist for accessing and navigating the database: browsing, simple text searches, directed Boolean queries, hypertext linking (both system- and user-defined), table of contents indices, back-of-the-book indices, glossaries, and design checklists.

CASHE will provide relevant information to the design engineer. It can be used as a means to explore human behavioral phenomena. Retrieval of information will be supported by bookmarks to allow recall of selections, cut-and-paste operations to allow export of useful information, and other features that allow the creation of personal notes and search strategies. Several of the P3 modules save experimental results and settings to a text file for use in post-processing applications.

Documentation:
Boff, K.R., and Lincoln, J.E., (eds.), "Engineering Data Compendium: Human Perception and Performance," Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH, 1988.

"Military Standard: Human Engineering Design Criteria for Military Systems, Equipment and Facilities," MIL-STD-1472D, U.S. Army Missile Command, Redstone Arsenal, AL, 1989.

Alternative/Comparable Approaches:
None known.

Stage of Development:
Available.

Date Current Version Released:
1994

Validation:
N/A, this contains human factors data, demonstrations of human factors phenomena, and design standards.

Comments:
"Perception and Performance Prototype (P3)" software has been integrated into the CASHE program. CASHE only runs on Macintosh computers. It was developed for MacOS 7 and has been used successfully under OS 8 and 9. HSIAC is not aware of anyone who has used in under OS X, but it should run under X's classic mode.

Technical Point of Contact is:
Don Monk
937-255-8814

How To Acquire:
Commercial Telephone: 937-255-4842
DSN: 785-4842
Fax: 937-255-4823

E-Mail: lisa.mcintosh@wpafb.af.mil If you send an E-Mail, you will be contacted by a representative who will confirm your order, provide you with the total charges, and request your payment information.

Mail:
Human Systems IAC Program Office
ATTN: Product Sales Manager
AFRL/HEC/HSIAC Bldg 29
2245 Monahan Way

Wright-Patterson AFB, OH 45433-7008

Title: Defense Instructional Technology Information System (DITIS)

Overall Category: Database/Information Center
Update: July 2004

Owner/Sponsor Organization: Defense Visual Information
http://dodimagery.afis.osd.mil/

Point of Contact Information:

Mr. Joseph L. Hickey
703-428-0640 DSN: 328-0640 FAX: 703-428-0478
jhickey@hq.afis.osd.mil

Product Specific Web Site:
http://dodimagery.afis.osd.mil/
Select DAVIS/DITIS

General Overview:
Instructional developers, trainers, planners, and policy makers are faced with decisions impacting both the quality and cost of Department of Defense (DoD) training. Many of these decisions involve the use of instructional technology. The types of issues these users must address include: development of cost-effective training for new weapon systems, identification of training that can be brought to the field or local site, managing within budgeted training funds, and revising training pipelines to meet operational requirements. The overall objective of the DITIS program is to improve the ability of training managers to quickly address these and related issues, thereby improving the quality of training while concomitantly reducing costs.

The primary purpose of DITIS is to facilitate the sharing of Interactive Multimedia Instruction (IMI) product resources within the DoD. From the field perspective, DITIS serves as the user interface to access and update IMI data, and satisfy the requirements of the DoD Directive (DODI 1322.20), Development and Management of Interactive Courseware (ICW) for Military Training (DODI 1322.20), regarding management and development of IMI. To accomplish this, a DITIS database, consisting of relevant information about currently fielded and developmental IMI training programs, was developed. This central source of information is designed to give IMI planners and developers a means of more efficiently using existing DoD IMI resources to meet training requirements.

The training developer accesses the DITIS database several times in the life cycle of an IMI program. These occur specifically during the following:

Initial Query -- By DoD directive, the DITIS database must be queried to determine what existing ICW programs meet, or can be cost-effectively modified to meet the user's training requirement.

Proposed Development -- As part of the requirements definition process, but before the decision to develop or fund an ICW program, general information about the proposed IMI program is entered into the system

Under Development -- Within 30 days following component approval to develop or fund the IMI program procurement, the originating activity enters updated program information describing the ICW program into the system.

Development or Acquisition Completion -- Within 30 days following completion of IMI program development or acquisition, the DITIS record for the program is updated to reflect the final program characteristics (including software and hardware requirements), and other management information

Program Revision -- The DITIS record is updated to reflect any major changes or additional data regarding the IMI program, such as modification, addition, or deletion of a module or lesson, within 30 days of any such revision or new data

Program Termination -- The DITIS record is updated to indicate program termination, removal from service, or similar change in status within 30 days of any such change.

User can determine if there is an already existing course, or one in development, that can be used or modified to suit their needs, thereby saving time and money. Sponsoring organization information is provided so that the courseware can be acquired for use. Some of the IMI products can be ordered directly through an on-line order form for direct shipment to the customer.

Equipment/Software Required:
The DITIS is accessed through the internet using a browser.

Input/Output/Processing:
Through the internet, DITIS provides input screens based on the DD Form 2568, Defense Instructional Technology Information System (DITIS) Report, to enter/update the individual IMI records. Searching DITIS is done by entering subject keywords.

Screen display of individual IMI record data, which can also be printed; information includes IMI description, uses, owner organization, and POC.

Documentation:
On the web site below select DAVIS/DITIS.

Stage of Development:
Operational, and in constant revision with new and updated IMI records.

Date Current Version Released:
March 17, 1999

Comments:
Any questions regarding the DITIS-DAVIS merge may be addressed to: Mr. Joseph Hickey, 703-428-0640 / DSN 328-0640, jhickey@hq.afis.osd.mil. No registration for an account is necessary to access the DITIS to search for IMI products.

Individuals/organizations interested in entering IMI records into the DITIS or in updating existing IMI product information, may register for an Edit ID at the above address by completing and submitting an online application form. Once you have received a message that your account has been validated, you will be provided with the correct address to enter the DITIS Administrative Site.

How To Acquire:
Point of Contact listed above.

Title: Defense Manpower Data Center (DMDC)

Overall Category: Database/Information Center
Update: January 2004

Owner/Sponsor Organization: Department of Defense
http://www.dmdc.osd.mil/

Point of Contact Information:

Mr. Vincent A. Lauter, Jr.
408-583-2400 DSN: 878-2951 FAX: 408-583-2340
lauterva@osd.pentagon.mil

Product Specific Web Site:
http://www.dmdc.osd.mil/

General Overview:
DMDC is the most comprehensive repository of personnel, manpower, training and financial data in the DoD. Our data and programs encompass the military personnel life cycle from accession to retirement, reserve components, families and dependents of Service Members, and civilian employees of the DoD. To facilitate the speed and accuracy of responding to data requests, DMDC maintains the data in a variety of media: files, data delivery systems, and published reports. DMDC also manages several operational programs using these databases. Automated Personnel data extends back in time to the early 1970s, while the other categories of data represent significant holdings, and in most cases provide the only single source of commonly coded data on the Military Services.

DMDC's primary function is to support the management information requirements of the Office of the Under Secretary of Defense for Personnel and Readiness (OUSD/P&R). We also provide data and analysis for other OSD offices, agencies, and individuals outside the DoD.

Use of the output varies as widely as our means of delivering it. Our customers, outside of the OUSD (P&R), include Congressional offices, the Office of Management and Budget, the Defense Finance and Accounting Service, the General Accounting Office, Office of Personnel Management, all military components, the Per Diem Travel and Transportation Allowance Committee, and various government contractors using the data for analysis. Among the many ways our data has been used operationally is in identification of delinquent debtors on Government Loan programs, setting active duty housing and living allowances, analyzing troop readiness, and in contributing to reports studying historical trends in the military.

Equipment/Software Required:
Virtually all DMDC's data delivery systems are now "Web-enabled" and only require the user to have internet access. Some are password protected. Equipment requirement questions and password questions are best answered by the system's point of contact at DMDC.

Input/Output/Processing:
DMDC has a standard operating procedure, depending upon the agency, to handle data requests. Some of DMDC's data is subject to the Privacy Act of 1974. DMDC ensures that the data is used in compliance with privacy act requirements and that adequate protection is taken for its safeguard. Every file, program, delivery system, and published report has a point of contact at DMDC who can guide you through the request process. Most of our services are free of charge; however, some Freedom of Information Act requests do involve a fee.

DMDC has created a Web-based Data Request System (DRS) for customers to submit their data and analysis requests. First time users enter background information, get a user name and password. URL is:
https://www.dmdc.osd.mil/drs

DMDC data resides primarily on a mainframe maintained at the Naval Postgraduate School in Monterey, CA. Most current data exists on Servers at the DMDC site in Oracle relational databases. We use a combination of packaged SAS, SYNCSORT) and in-house developed programs to manipulate the data files on the mainframe. Depending upon the anticipated use of the data, output from the mainframe may be downloaded to the level of a personal computer or Oracle database on a Server for further analysis and cleaning. DMDC's Information Delivery System provides personal computer desktop information to the user via the Internet, and can be downloaded in a spreadsheet environment. DMDC also has about 70 other web-based applications depending on user need.

Output can be delivered in almost any way that is most convenient for the customer. Traditionally, output has been generated as spreadsheets, reports, graphs, and frequency distributions. The output can be downloaded to discs, tapes, reels, and CDs. Sometimes the output is printed, and then mailed or faxed to the customer; sometimes the data is sent FTP/electronically. DMDC has also developed data delivery systems that, through a graphical user interface, report the data on user-friendly PC screens. Data is typically also provided by e-mailing spreadsheets.

Documentation:
2004 DMDC Profile: This book, scheduled for publication in February 2004, lists and describes the files, operational programs, data delivery systems, and published reports available to our customers. This document is available at URL: http://www.dmdc.osd.mil

Alternative/Comparable Approaches:
DMDC is widely recognized as the only source of automated DoD personnel data that crosses Services and type of DoD employment, and that can provide data in a quick response mode to those doing analysis of the DOD workforce.

Stage of Development:
As a growing and dynamic organization, DMDC has developed new projects to meet the needs of our customers. Many of the current projects in development are using the latest computer and communications systems, multi-media technology, and the Word Wide Web.

How To Acquire:
Point of contact listed above.

Title: Defense Technical Information Center (DTIC)

Overall Category: Database/Information Center
Updated: September 2004

Owner/Sponsor Organization: Defense Technical Information Center (DTIC)
http://www.dtic.mil/

Point of Contact Information:

Directorate of User Services, DTIC-BC (Marketing Team)
800-225-3842 DSN: 427-8268 FAX: 703-767-8228
bcporder@dtic.mil

Product Specific Web Site:
http://www.dtic.mil/dtic/prodsrvc/

General Overview:
DTIC is the central repository for the collection, storage, retrieval and dissemination of planned, ongoing or completed Defense-related research in support of the DoD Scientific and Technical Information Program (STIP). The scope of DTIC's collection includes areas normally associated with Defense research; however, since DoD's interests are widespread, the collection also contains information on areas of interest including but not limited to biology, chemistry, energy, environmental sciences, oceanography, computer sciences, sociology, logistics, and human factors engineering. DTIC holdings include: technical reports, summaries of research in progress, defense technology transfer agreements, studies and analyses, security classification guides, gray literature such as journal articles, conference proceedings and foreign documents and translations, DoD-sponsored patents and patent applications, DoD-sponsored software, DoD directives and instructions, DoD planning and budget documents, dissertations and theses from DoD schools. The collection encompasses all DoD-relevant technology areas, which includes the technologies covered in the Directory of Design Support Methods (DDSM).

Among DTIC's products and services are online services, a variety of current awareness products, and CD-ROM search tools. Full-text unclassified, unlimited and limited documents and Research Summaries are available through DTIC's Private STINET Service on the Web. Additionally, DTIC hosts over 100 Web sites, including DefenseLINK, the official DoD Homepage, and DTIC's own homepage (http://www.dtic.mil/).

Due to the nature of the material handled, users must qualify for services from DTIC. U.S. Government organizations and their contractors are eligible to register for DTIC's products and services. The general public can search DTIC's unclassified technical report bibliographic database (1974 to present) on its Public STINET service at http://stinet.dtic.mil/. Full-text unclassified, unlimited documents received by DTIC from September 1998 may be downloaded from this site.

The contributor of the information, if any, assigns classification of the information and the distribution restrictions. Non-government organizations must complete DD Form 2345, Militarily Critical Technical Data Agreement, in order to get export-controlled information. Need-to-know authorization and a facility clearance are needed to obtain classified information.

Equipment/Software Required:
The DTIC Web site can be accessed using any of the common Web browsers.

Input/Output/Processing:
Services are available to registered DTIC users. To request a registration packet, contact DTIC's Registration Branch: 800-225-3842; e-mail, reghelp@dtic.mil, or register online at
https://register.dtic.mil/wobin/WebObjects/DTICreg

DTIC accepts and disseminates information in paper, microfiche, nonprint, multimedia and electronic formats. Information about submitting information to DTIC can be found at: http://www.dtic.mil/dtic/submitting/

Documentation:
http://www.dtic.mil/dtic/prodsrvc/

Alternative/Comparable Approaches:
DTIC is the comprehensive collection of DoD scientific, research and engineering documents. DTIC provides the National Technical Information Service (NTIS) with copies of technical reports that have a security classification of unclassified, unlimited (information that is available to the general public).

Stage of Development:
DTIC's databases are mature and are updated on an ongoing basis. New products are periodically offered, as well as additions of information to the DTIC Web site.

How To Acquire:
Point of Contact listed above.

Title: Human Systems Information Analysis Center (HSIAC)

Overall Category: Database/Information Center
Update: July 2004

Owner/Sponsor Organization: Defense Technical Information Center / Air Force Research Laboratory
http://iac.dtic.mil/hsiac/

Point of Contact Information:

Dr. Joe W. McDaniel
Human Systems Information Analysis Center
937-255-4842 DSN: 785-4842 FAX: 937-255-4823
joe.mcdaniel@wpafb.af.mil

Product Specific Web Site:
http://iac.dtic.mil/hsiac/

General Overview:
HSIAC (formerly the Crew System Ergonomics Information Analysis Center [CSERIAC]) is a DoD Information Analysis Center (IAC). It provides information analysis services related to human factors, ergonomics, and human systems integration to support research, design, and development of space, air, surface, and subsurface crew systems.

HSIAC functions as a gateway to worldwide sources of behavioral, biomedical, and engineering information for engineers, designers, and human factors specialists. HSIAC primarily supports the DoD and other government organizations and their contractors. HSIAC also is available to other types of users, domestic and international, academic and corporate, to the extent practicable within the DoD security guidelines and DoD policy regarding the handling of information on military critical technologies.

HSIAC provides various products and services on a cost-recovery basis in response to expressed or anticipated needs. These information products and services include handbooks and data books, state-of-the-art reports and technology assessments, research directories, abstracts, indexes, symposia, panels, workshops, and short courses. HSIAC also offers a variety of services including customized responses to technical and bibliographic inquiries, support for revision and development of military standards and specifications, and maintaining and implementing computer-based models of human performance.

Documentation:
http://iac.dtic.mil/hsiac/

Alternative/Comparable Approaches:
Information Analysis Centers (IAC) are DoD-sponsored centers which provide scientific, technical, and support services to government, industry, and academic communities. Each IAC serves a vital technical or mission area.

Stage of Development:
HSIAC is fully operational.

Comments:
The Human Systems IAC Gateway is a quarterly newsletter which addresses current issues in the area of human factors/ergonomics. The Gateway Newsletter is available free of charge on the HSIAC web site.
http://iac.dtic.mil/Gateway.htm#Past

How To Acquire:

Point of Contact listed above.

Title: MATRIS Office

Overall Category: Database/Information Center
Updated: July 2004

Owner/Sponsor Organization: Defense Technical Information Center (DTIC)
http://www.dtic.mil/

Point of Contact Information:

Ms. E. Byars Vicino
619-545-7488 DSN: 735-7488 FAX: 619-545-0019
bvicino@dticam.dtic.mil

Product Specific Web Site:
http://www.dtic.mil/matris/

General Overview:
The MATRIS Office of the Defense Technical Information Center (DTIC) provides:

I. A centralized source of people-related research information:
- Manpower & Personnel
- Training Technology
- Training Systems
- Human Performance
- Human Factors/Human Systems Integration
- Biomedical
- Safety & Survivability

II. Business assistance:
- DoD SBIR/STTR Information and Links
- DoD Technology Transfer Research

Services include:
- Website of resources
- Reports and publications
- Database development and maintenance
- Web Site development
- Research information, with points of contact
- In-house search and retrieval services

The MATRIS Web Site is publicly accessible and contains several focused R&D databases, a gateway to other resources, and electronic versions of some of MATRIS publications. MATRIS search specialists provide search services of DTIC databases and can produce reports in custom formats as requested by the client. Our knowledgeable staff can provide referral to the R&D resources that meet the needs of the client.

Database development and maintenance, and Web Site development and housing services are available to Department of Defense agencies.

MATRIS services are designed to:
- Prevent duplication of research through sharing of R&D information;
- Facilitate the ability of researchers and developers to build upon lessons learned;
- Fulfill Department of Defense (DoD) subject matter search requirements;
- Enhance research coordination within and outside the DoD;
- Assist small businesses doing R&D.

Equipment/Software Required:

The MATRIS Web Site can be accessed using any of the common Web browsers. A phone call or email is all that is required to request DTIC search services.

Input/Output/Processing:
All MATRIS web databases and products can be captured or downloaded, without cost. Reports prepared by the MATRIS staff can be provided in hardcopy or electronic format. MATRIS also produces periodic hardcopy publications.

Documentation:
MATRIS products and services are described on the Web Site; a brochure is also available.

Alternative/Comparable Approaches:
The "Directory of Design Support Methods (DDSM)" is only available from MATRIS. Other services provided by MATRIS can be individually obtained from other sources or done by the user. For instance, the client can go directly to STINET, Defense Technical Information Center, and do their own search of DTIC databases.

Stage of Development:
Mature; all services are available.

Comments:
Web and database development are available to DoD-level agencies. Search services are available to any Defense Technical Information Center (DTIC) registered user and to members of the Department of Defense Human Factors Engineering Technical Advisory Group (DoD HFE TAG).

How To Acquire:
Point of Contact listed above.

Title: Modeling and Simulation Information Analysis Center (MSIAC)

Overall Category: Database/Information Center
Update: July 2005

Owner/Sponsor Organization: Defense Modeling and Simulation Office (DMSO)
http://www.msiac.dmso.mil/

Point of Contact Information:

Mr. Bill Marshall
703-933-3344 FAX: 703-933-3325
msiac@msiac.dmso.mil

Product Specific Web Site:
http://www.msiac.dmso.mil/

General Overview:
MSIAC is established to access, acquire, collect, analyze, synthesize, generate, and disseminate Scientific, Technical and Operational Support Information (STOSI) related to Modeling and Simulation (M&S). As a DoD Information Analysis Center (IAC), MSIAC unites the scientific and technology information services related to M&S, formerly provided by DMSTTIAC, and the M&S operational support services perspective, previously provided by MSOSA.

MSIAC supports the DoD M&S community, including the industrial infrastructure and academia, and facilities appropriate technology transfer. MSIAC assists the M&S community by providing a range of services, including direct assistance to M&S users. MSIAC supports the DTIC objective of STOSI collection and dissemination by maintaining active contact with the DoD organizations and researchers that employ and develop M&S technology for the purposes of:

- Training (including analysis of tactical options, and mission rehearsal
- Analysis (of alternative force structures, strategic/operational courses-of-action, and program resource options)
- Acquisition (including system research, development, test, evaluation, and life-cycle support)
- To contribute to the organized body of knowledge on Modeling and Simulation
- To educate senior leaders, managers and staffs in M&S technology and applications
- To assist users in evaluating models, simulation, and related technology for specific purposes.
- To supplement M&S staffs with tailored information, and skilled, experienced professional manpower for operations, training, analysis, or other support tasks.
- To provide M&S staffs with information that saves time and money.

Equipment/Software Required:
WWW access or telephone. STU-III and SIPRNet available.

Input/Output/Processing:
Help Desk Queries (up to 2 hours research at no cost to non-DoD related activities; up to 8 hours research free to DoD organizations). Email: msiachelp#msiac.dmso.mil, or from the MSIAC home page at http://www.msiac.dmso.mil/ click on "Help Desk" and complete the on-line inquiry form (preferred).

For government agencies and other approved clients MSIAC also performs Technical Area Tasks (TATs). TATs provide knowledge products for the M&S community, and a responsive, cost-effective contracting option for support tasks related to the MSIAC mission.

MSIAC relies on a range of tailored bibliographic and Resource databases, including the Modeling and Simulation Resource Repository (MSRR) and the core military and simulation expertise of our staff. Some

information is publicly accessible through Links and Special Interest Areas on the MSIAC Home Page (http://www.msiac.dmso.mil). Individual registration and sponsor approval may be required for access to specific information.

MSIAC products and services are delivered in four formats:
1) General Help Desk queries are usually replied to by email or telephone.
2) Certain general M&S and/or project-related information is available on-line via the MSIAC web site.
3) Education and training courses are available in M&S topics tailored to defense-related and general audiences.
4) State-of-the-Art Reports, Technical Assessments, bibliographic reviews, databases, and other tailored products are issued in digital and traditional hard-copy publishing formats.

Documentation:
A link to a list of available M&S products can be found on the MSIAC Home Page.

Stage of Development:
MSIAC was established in June of 1999, and is fully operational. MSIAC builds directly on five years of experience from its two predecessor organizations, DMSTTIAC and MSOSA

Comments:
Help Desk Manager - Mr. Michael Meehan
703-933-3323

The DISTRIBUTION CODE (distribution limitation) for MSIAC products varies depending on U.S. Government dissemination guidance for specific types of information and types of service performed by MSIAC.

How To Acquire:
Point of Contact listed above.

Title: Reliability Analysis Center (RAC)

Overall Category: Database/Information Center
Updated: July 2004

Owner/Sponsor Organization: Defense Technical Information Center (DTIC)
http://rac.alionscience.com

Point of Contact Information:

Patrick Hetherington, Director
315-337-0900 FAX: 315-337-9932
rac@alionscience.com

Product Specific Web Site:
http://rac.alionscience.com

General Overview:
The Reliability Analysis Center (RAC) has served as a Department of Defense (DoD) Information Analysis Center (IAC) for more than 35 years. As an IAC, RAC is a Center of Excellence and technical focal point for information, data, analysis, training and technical assistance in the engineering fields of Reliability, Maintainability, Supportability, and Quality (RMSQ).

The Reliability Analysis Center provides the information, tools, training, and technical expertise in the engineering disciplines of Reliability, Maintainability, Supportability, and Quality (RMSQ) to support accurate decision making and implement cost-effective solutions throughout all phases of a product or system life cycle.

Equipment/Software Required:
WWW access, phone, or fax

Alternative/Comparable Approaches:
Information Analysis Centers (IAC) are DoD-sponsored centers which provide scientific, technical, and support services to government, industry, and academic communities. Each IAC serves a vital technical or mission area.

Stage of Development:
RAC is fully operational.

How To Acquire:
Point of contact listed above.

Title: Requirements Analysis Tool (RAT)

Overall Category: Database/Information Center
Updated: August 2005

Owner/Sponsor Organization: Naval Air Warfare Center - Weapons Div (NAWCWPNS)

Point of Contact Information:

Ms. Gene Schneider
House of Hrair
760-384-8532
gschneider@iwvisp.com

General Overview:

RAT is a database structure used to document and track evolution of system or project requirements. The information in RAT includes:

1. Requirement Identification (based on a system/project Functional Hierarchy).
2. Requirement Definition (including name, description, implementation, and comments).
3. Requirement Source(s).
4. Requirement Testing Data.
5. Database Configuration Management Data.

The main purpose of RAT is to provide requirement traceability throughout the lifecycle of a project; specifically, RAT is used to generate traceability tables for project projects. Other uses to which various versions of RAT have been put include:

1. Presentation slides for Requirements Reviews.
2. Tables of contents for documents and presentation slides.
3. Main body text of certain requirements documents.
4. Audit tables for evaluating test and document completeness.
5. Documentation of requirement allocation to test modes, "media" (hardware, software, and liveware), and subsystems.

Equipment/Software Required:

The current implementation is in Claris Filemaker Pro, which works on both MacIntosh and PC (Windows or DOS) computers. But the RAT "method" is generic, not limited to particular equipment or software.

Input/Output/Processing:

The main inputs are system/project requirements, in any form in which they may exist. The person who enters the requirements into RAT must do minor editing to determine which parts of the requirement are to be used for the description, implementation, and comments part of the database record, and what to use for the requirement "name" (which begins with a verb from a standard list).

Other inputs are:

1. Functional Hierarchy identifier (from a separate database).
2. Analysis data on types of testing to be performed.
3. Analysis data on allocation of requirements to subsystems.

The Requirement Identifier, made up of the Functional Hierarchy identifier and a "sequence number," is required. The other inputs are optional for the main purpose of RAT, but required for secondary uses.

The person entering data into RAT must categorize the information in the source documents as being part of the name, description, implementation, or comments about the requirement. In many cases, this person must also analyze where one requirement ends and another begins, based on knowledge of the system or project.

Before the RAT data can be used in reports, someone must assign unique identifiers to each requirement. This requires assigning each requirement to a place in the Functional Hierarchy, and adding a "sequence number" to distinguish this requirement from others linked to the same Hierarchy item. (The "sequence number" may have its own hierarchical structure, effectively taking the hierarchy to lower levels of detail, or may just be a number.)

1. Traceability tables for use in system/project documents.
2. Presentation slides for Requirements Reviews.
3. Tables of contents for documents and presentation slides.
4. Main body text of certain requirements documents.
5. Audit tables for evaluating test and document completeness.

Documentation:
RAT Data Book...available from the POC. (See comment in "Stage of Development.)

Alternative/Comparable Approaches:
There are several commercial products that attempt to provide documentation and traceability of requirements. The two best ones are:
1. RDD - [Unix] total system model; not enough info on requirements.
2. RTM - [DOS] too constrained: report formats, field sizes and types, etc.

Stage of Development:
RAT (and FHier, the Functional Hierarchy database) have been in use by various Navy avionics projects for almost 10 years. So the method itself is robust. Unfortunately, however, there has never been time to document the databases and their usage procedures formally, so documentation is mostly in the form of presentation slides.

The two database formats (RAT and FHier) and associated documentation (in Microsoft WORD) are available on Macintosh disc from the POC.

Comments:
Effective use of RAT assumes the existence of a Functional Hierarchy, in which is exactly and the only one place to assign each system or project requirement. Creating such a hierarchy is difficult.

We have investigated each commercial "Requirements Management System" as it becomes available, and have not found any that meet our needs. The fatal flaw in most of them is assuming that you START WITH a viable requirements document, the table of contents of which is a meaningful "Functional Hierarchy." In our environment, we need RAT to gather requirements from man sources, design a meaningful Functional Hierarchy to attach them to, and then GENERATE a viable requirements document.

How To Acquire:
Point of Contact listed above.

HANDBOOKS/GUIDES/COURSES

Title: Air Force Systems Command Design Handbooks

Overall Category: Handbook/Course
Update: June 2005

Owner/Sponsor Organization: Aeronautical Systems Center
http://engineering.wpafb.af.mil/

Point of Contact Information:

Ms. Cheryl Copes
937-904-5476 DSN: 785-5476 FAX: 937-656-7700
cheryl.copes@wpafb.af.mil

Product Specific Web Site:
http://engineering.wpafb.af.mil/engstds/engstds.asp

General Overview:
The Design Handbooks are specialized publications which provide an authoritative source of design data in support of the definition, design, and development of Air Force systems and equipment. There are currently 16 handbooks distributed on CD-ROM. Although the Design Handbooks have not been maintained in recent years, they contain a wealth of information. DH 1-3, Human Factors Engineering is one handbook within the General Design Criteria series. The second series contains handbooks for Aeronautical Systems design criteria.

The Handbooks are used in applying technical knowledge to Air Force system and equipment acquisition programs. They are intended to convey proven techniques and to prevent repetition of past research and development errors.

Alternative/Comparable Approaches:
Mil-Prime and Joint Service Specification Guides documents.

Stage of Development:
Historical.

Date Current Version Released:
1-2 General Design Factors 4th Edition 20 Feb 79, Rev 5 - 19 Feb 85 (Reprint 1 Apr 93)
1-3 Human Factors Engineering 3rd Edition 1 Jan 77, (Reprinted 25 Apr 85) Rev 2 - 25 Sep 87
1-4 Electromagnetic Compatibility, 4th Edition 2 Mar 84, Rev 1- 31 Jan 91 (Reprinted 19 Nov 92)
1-5 Environmental Engineering, 4th Edition - 5 Oct 83, Rev 2 13 apr 90 (Reprinted 5 Oct 83)
1-6 System Safety, 5th Edition - 20 Dec 78, Rev 2, 13 Apr 90 (Reprinted 10 Aug 92)
1-7 Aerospace Materials, 2nd Edition - 20 Oct 88
1-8 Michrolectronics, 4th Edition - 5 Sep 77, Rev 3 - 1 Apr 86 (Reprinted 26 Nov 92)
1-9 Maintainability, 2nd Edition - 20 Dec 73, Rev 7 - 25 Feb 88 (Reprinted 10 Oct 86)
1-11 Air Transportability, 1st Edition - 25 Sep 76, Rev 4 20 Feb 80 (Reprinted 10 Jun 92)
2-1 Air Frame, 4th Edition, 15 May 85 (Reprinted 12 Jun 92)
2-2 Crew Stations & Passenger Accommodations, 3rd Edition - 1 Nov 79, Rev 2 5 Apr 91 (Reprinted 15 Apr 86)
2-3 Propulsion and Power, 3rd Edition - 25 Aug 79, Rev 1 - 27 Aug 80 (Reprinted 20 Aug 84)
2-5 Armament, 3rd Edition - 15 Nov 79, Rev 1 - 30 Mar 85 (Reprinted 30 Jun 88)
2-6 Ground Equipment and Facilities, 4th Edition - 10 Feb 79, Rev 1 - 30 Jun 88 (Reprinted 15 Aug 84)
2-8 Life Support, 2nd Edition - 1 Sep 78, Rev 1 - 14 Oct 83 (Reprinted 15 Jul 86)

Comments:
All handbooks are available on CD ROM in PDF format.

The distribution of Design Handbooks is limited to DoD employees and to those on the Defense Logistics Services Center's list of certified DoD contractors. Contractors who wish to become certified must fill out and submit to DLSC a Form DD 2345.

How To Acquire:
Order from Point of Contact listed above.

Title: Engineering Data Compendium: Human Perception and Performance

Overall Category: Handbook/Course
Update: July 2004

Owner/Sponsor Organization: Human Systems Information Analysis Center
http://iac.dtic.mil/hsiac/

Point of Contact Information:

Dr. Joe W. McDaniel
937-255-4842 DSN: 785-4842 FAX: 937-255-4823
joe.mcdaniel@wpafb.af.mil

General Overview:

A landmark human engineering reference for system design, the three volume, hard copy, Compendium has 2,758 pages with approximately 2,000 figures and tables. Included is a User's Guide. The Compendium contains twelve sections which include: Information Acquisition, Spatial Awareness, Perceptual Organization, Attention, Resource Allocation, Language Processing, Motor Control, Environmental Stressors, and Display and Control Interfaces.

The Compendium is a reference for principles, mathematical functions, graphical representations, and design criteria relevant to human engineering for system design. The Compendium incorporates and integrates large masses of information and provides easy access to human performances data and engineering principles for use in the system design process.

Users with formulated system design problems can consult the Compendium for relevant human engineering data, theory, and methods that can be used for solution of the problem. Users can select among several structured approaches for accessing information depending on how well the design issue has been defined. Each major topical section contains a tab-locatable table of contents, glossary, and knowledge map providing a relational hierarchy of subtopics covered.

The Compendium gives data, methods, and theories relevant to the solution of design problems. The information is segmented into concise two-page entries addressing relatively narrow topics. The goal is to provide information in discrete units easily understood by a user with little experience in the topic area.

Documentation:

Boff, K.R., Kaufman, L., Thomas, J.P. (Eds.), “Handbook of Perception and Human Performance”, John Wiley & Sons, NY, 1988.

Stage of Development:

The Compendium is currently available from HSIAC for a cost-recovery fee.

Date Current Version Released:

1988

Comments:

The Compendium is sold as a set consisting of 3 data volumes and a User's Guide.

HSIAC is an Information Analysis Center (IAC) operated by Booze, Allen, Hamilton and sponsored by the Defense Technical Information Center and the Air Force Research Laboratory.

How to Acquire:

Mail: AFRL/HEC/HSIAC, Bldg. 29, ATTN: Products & Services, 2245 Monahan Way, Wright-Patterson AFB, OH 45433-7008
Phone: 937-255-4842 / DSN 785-4842
Fax: 937-255-4823 / DSN 785-4823

Title: A Guide for Early Embedded Training Decisions, Second Edition

Overall Category: Handbook/Course
Updated: July 2004

Owner/Sponsor Organization: U. S. Army Research Institute for the Behavioral and Social Sciences
http://www.ari.army.mil

Point of Contact Information:

Dr. Bob G. Witmer
407-384-3995 DSN: 970-3995 FAX: 407-384-3999
bob.witmer@peostri.army.mil

General Overview:
Embedded Training (ET) is training built into or added to a weapons system. Although Army policy requires training developers to consider ET before other training options, effective implementation of this policy has been hampered by the lack of specific procedures to determine whether training should be embedded or not. This document provides a set of guidelines--in the form of detailed decision flowcharts-- to assist training developers and engineers in making early ET decisions. Although information about task characteristics has traditionally determined selection of media for training, it is now considered less important in deciding when to use ET than the following factors: policy; system availability for training; technical feasibility of ET implementation; effects of ET on system reliability, availability, and maintainability; impact of ET on system manpower and personnel requirements; need for training-specific interface hardware; safety; and cost-effectiveness.

The Guide is appropriate for those with responsibilities for training development and for the MANPRINT domain of training in all stages of the development cycle and for all milestones. Embedded Training is a mandated part of training development for any new systems or systems undergoing modification, MANPRINT, and the Integrated Logistics Support program.

Equipment/Software Required:
No equipment per se is necessary to implement ET development methods; however, a database management system for manipulating task data would be of considerable assistance.

Input/Output/Processing:
The inputs necessary for this method include all available information on the missions and tasks to be performed, the soldier-machine interface, the computer subsystem architecture and software, and similar information on comparable systems.

The processing techniques used on the input data vary as a function of the objective to be achieved and the availability of information related to that objective. The technique for each objective is specified in the guideline and procedures section pertaining to that objective.

The output consists of an analytic basis for decisions regarding the feasibility of incorporating ET into the system to accomplish specific training objectives; and, if feasible and of value, recommends the type of embedded training to be used. Other training alternatives may be recommended as well. Other outputs include guidance for test plans, design of the supporting logistics system, and inputs to system acquisition documents (e.g., requirements documents, statements of work).

Documentation:
The Guide has a list of ET references. Defense Technical Information Center: Technical Report AD A315 823.

Alternative/Comparable Approaches:

This Guide extends and compliments a larger ten volume set which was the result of the ET methods development program completed by ARI, Ft. Knox. The ten volumes of guidelines and procedures, plus two additional reports extending Volumes 3 and 5, are available through Defense Technical Information Center (DTIC).

Each of the ten volumes has, as the first part of the title, "Implementing Embedded Training (ET):...". Following are the document subtitles and the corresponding DTIC accession numbers:

Vol. 1- "Overview," AD A201 401
Vol. 2- "ET as a System Alternative," AD A2 04 836
Vol. 3- "Roles of ET in the Training System Concept," AD A201 427
Vol. 4- "Identifying the ET Requirements," Revised, AD A205 752
Vol. 5- "Designing the ET Component," Revised, AD A205 697
Vol. 6- "Integrating ET with the System," AD A207 982
Vol. 7- "ET Test and Evaluation," AD A207 290
Vol. 8- "Incorporating ET into Army Unit Training," AD A207 509
Vol. 9- "Logistics Implications," AD A206 794
Vol.10- "Integrating ET into Acquisition Documentation," AD A207 240

Stage of Development:
Complete.

Date Current Version Released:
July 1996

Comments:
All major requirements documents must include provisions for possible ET. Otherwise, preliminary designs may lack the computer, control, and display capacity and flexibility to permit later insertion of ET. The Point of Contact listed above is the technical POC. The Guide is available through DTIC.

How To Acquire:
Defense Technical Information Center (DTIC): Technical Report AD A315 823.
Search DTIC Public STINET http://stinet.dtic.mil/ , or
Contact DTIC: Defense Technical Information Center, Reference and Retrieval Division, ATTN: DTIC-BR, 8725 John J. Kingman Rd., Ste. 0944, Ft. Belvoir, VA 22060-6218. Phone: (703) 767-8274 / DSN 427-8274.

Title: A Handbook for MANPRINT in Acquisition

Overall Category: Handbook/Course
Update: August 2004

Owner/Sponsor Organization: Headquarters Department of the Army (HQDA), Army-G1, MANPRINT Directorate
http://www.manprint.army.mil/

Point of Contact Information:

Ms. Teresa Hanson
703-695-5848 DSN: 225-5848 FAX: 703-695-6997
teresa.hanson@hqda.army.mil

General Overview:
The Manpower and Personnel Integration (MANPRINT) program was initiated to influence materiel system design by considering soldier capabilities and limitations as integral elements of total system performance. This is achieved by the continuous integration of seven human-related considerations: personnel capabilities, manpower, training, human factors engineering, system safety, health hazards, and soldier survivability.

The Handbook provides information on MANPRINT in general, the acquisition life cycle, the System MANPRINT Management Plan (SMMP), and the missions and composition of MANPRINT Working Integrated Concept Teams (ICT)/Integrated Product Teams (IPT). It also provides detailed advice on the activities that should be accomplished in each life cycle phase, and discusses the DCSPER MANPRINT Assessment process. It has been updated to reflect the guidance contained in the latest approved DoDD 5000.1 and DoDR 5000.2-R.

General information includes: MANPRINT; System MANPRINT Management Plan (SMMP); Missions and Compositions of MANPRINT Working Integrated Concept Teams (ICT)/Integrated Product Teams (IPT); Life Cycle Phases; MANPRINT Assessment Process.

This Handbook is designed as a guide for those individuals responsible for coordinating, guiding, implementing, and managing MANPRINT in the acquisition of both automated information systems (AIS) and materiel systems early in the acquisition process.

Documentation:
Self-contained in the Handbook.

Stage of Development:
Completed. Some changes to the Handbook may be required as revisions evolve to other publications, such as AR 602-2 and the applicable DoD directives.

Comments:
This Handbook replaces the MANPRINT User's Source Guide (MUSG).

How To Acquire:
Point of Contact listed above.

Title: Human Systems Integration (HSI) Executive Seminar

Overall Category: Handbook/Course
Update: May 2004

Owner/Sponsor Organization: 311th Human Systems Wing – Acquisition and Environmental Planning
http://www.brooks.af.mil/HSW/

Point of Contact Information:

Mr. Adrian O. Salinas
210-536-4428 DSN: 240-4428 FAX: 210-536-4475
adrian.salinas@brooks.af.mil

General Overview:
This is a one to five days in length course, supported with a modified high-level, one to four-hour seminar structure available for specialty presentations. This material is designed to provide an overview of human systems integration considerations in Air Force systems acquisition. The full length lessons focus on the incremental HSI process and analyses in relation to the Defense Acquisition Process; the seven HSI elements (manpower, personnel, training, safety, human factors, health hazards, survivability); tools, techniques and databases for HSI analyses; and organizational functional relationships in the HSI process, with emphasis of the roles of the MAJCOM HSI OPR, the HSI Program Planning Team, and the and the HSI Program Planning process in facilitating integration of HSI requirements.

The Executive Seminar is intended for General Officers, Senior Executive Service professionals, SPDs and SPMs, and Air Staff Element OPRs. The objective is to familiarize them with the seven HSI elements and their interactions, the benefits of an HSI Program, available tools, techniques and databases for analyses, and basic HSI requirements within the systems acquisition process.

Students should be aware of basic DoD and Air Force HSI requirements, and understand the benefits of the HSI Program.

Input/Output/Processing:
No student inputs are required.

Current mode of instruction is traditional classroom, lecture, exercise.

Output is basic familiarization with the concept of human systems integration and its implementation by the Air Force. A copy of the course is provided for each student to keep.

Documentation:
DoDD 5000.1; DoD Regulation 5000.2; AFI 10-601.

Alternative/Comparable Approaches:
Army MANPRINT courses.

Stage of Development:
Fully developed.

How To Acquire:
Point of Contact listed above.

Title: Human Systems Integration (HSI) Familiarization Course

Overall Category: Handbook/Course
Update: May 2004

Owner/Sponsor Organization: 311th Human Systems Wing – Acquisition and Environmental Planning
http://www.brooks.af.mil/HSW/

Point of Contact Information:

Mr. Adrian O. Salinas
210-536-4428 DSN: 240-4428 FAX: 210-536-4475
adrian.salinas@brooks.af.mil

General Overview:
The HSI Familiarization Course is designed to provide an overview of human systems integration considerations in AF systems acquisition. Lessons focus on the HSI process and analysis in relation to the Defense Acquisition Process; the seven HSI elements (manpower, personnel, training, safety, human factors, health hazards, and survivability); tools, techniques, and databases for HSI analyses; and organizational functional relationships in the HSI process, with emphasis on the roles of the MAJCOM HSI OPR, and the program office systems engineer in facilitating integration of HSI requirements.

The Familiarization Course is intended for MAJCOM requirements generators or planning team members, SPO system engineers or analysts, Technical Planning Integrated Project Team (TPIPT) members, Deputy Program Manager for Logistics, and Air Staff Element OPRs. The objective is to familiarize them with the seven HSI elements and their interactions, the structure of an HSI program. Planning process, how to utilize the available tools, techniques and databases for analyses, how to access those tools and databases, and how to conduct an HSI Planning Team.

Students should be able to form and lead, or participate in knowledgeably, an HSI exercise.

Input/Output/Processing:
No student inputs are required.

Current mode of instruction is traditional classroom, lecture, exercise.

Output is basic familiarization with the concept of Human Systems Integration and its implementation within the Air Force. A copy of the course is provided for each student to keep.

Documentation:
DoDD 5000.1; DoD Regulation 5000.2; AFI 10-601.

Alternative/Comparable Approaches:
Army MANPRINT courses.

Stage of Development:
Requires update before each delivery.

Comments:
This course is currently consolidated into a 2-4-hour seminar that is intended to be a top-level overview of HSI. The entire program is now under the direction of 311th Human Systems Wing, Acquisition and Environmental Planning (311 HSW/XPRA).

How To Acquire:

Point of Contact listed above.

Title: Human Systems Integration (HSI) - The HSI Requirements Development Course

Overall Category: Handbook/Course
Updated: May 2004

Owner/Sponsor Organization: 311th Human Systems Wing – Acquisition and Environmental Planning
http://www.brooks.af.mil/HSW/

Point of Contact Information:

Mr. Adrian O. Salinas
210-536-4428 DSN: 240-4428 FAX: 210-536-4475
adrian.salinas@brooks.af.mil

General Overview:
This is a one to five days in length course, with modified high level one to four-hour seminar structure course which is designed for acquisition professionals, both federal government military and civilians and DoD contractors who will work as HSI support practitioners, or support HSI activities within the requirements development process under the acquisition and life cycle support environment. Its focus is to provide students with a working knowledge of the HSI program with the skills needed to perform their duties as requirement developers integrating human performance considerations into the acquisition process. The full length lessons focus on the incremental HSI process and analyses in relation to the Defense Acquisition Process; the seven HSI elements (manpower, personnel, training, safety, human factors, health hazards, survivability); tools, techniques and databases for HSI analyses; and organizational functional relationships in the HSI process, with emphasis of the roles of the MAJCOM HSI OPR, the HSI requirements developer, the Program Planning Team, and the HSI Program.

The HSI Requirements Development Course is designed to support acquisition professionals, requirements developers, DPMLs, and SPDs/SPMs, and Air Staff Element OPRs. The objective is to familiarize them with the seven HSI elements and their interactions, the benefits of an HSI Program, available tools, techniques and databases for analyses, and basic HSI requirements development process within the systems acquisition process.

Students should be aware of basic DoD and Air Force HSI requirements, and understand the benefits of the HSI Program.

Input/Output/Processing:
Students should be aware of basic DoD and Air Force HSI requirements, and understand the benefits of the HSI program.

Current mode of instruction is traditional classroom, lecture, and exercise.

Output is basic familiarization with the concept of human systems integration and its implementation by the Air Force. A copy of the course is provided for each student to keep.

Documentation:
DoDD 5000.1; DoD Regulation 5000.2; AFI 10-601.

Alternative/Comparable Approaches:
Army MANPRINT courses.

Stage of Development:
Fully developed.

How To Acquire:

Point of Contact listed above.

Title: Introduction to Human Systems Integration

Overall Category: Handbook/Course
Updated: May 2004

Owner/Sponsor Organization: 311th Human Systems Wing - Acquisition and Environmental Planning
http://www.brooks.af.mil/HSW/

Point of Contact Information:

Mr. Adrian O. Salinas
210-536-4428 DSN: 240-4428 FAX: 210-536-4475
adrian.salinas@brooks.af.mil

General Overview:

The Introduction to Human Systems Integration course is designed to promote awareness of HSI concepts and to assist acquisitions professionals in establishing the knowledge needed to put HSI principles in practice. Course content is arranged in two modules. Module One represents relevant examples of DoD HSI usage; comprehensively defines HSI, conceptually and in terms of the elements that comprise it; and provides guidance on the policies governing HSI usage. Module Two consists of a simulation in which you apply your newly acquired HSI knowledge to navigate and successfully complete various acquisitions scenarios.

Through instruction and interactive activities presented in this introductory course, you will become familiar with HSI concepts and strategies – learning how to integrate human considerations throughout the systems lifecycle; to make decisions geared towards optimizing total system performance and minimizing overall lifecycle costs. If you would like to receive credit for this course, please continue to the Air Force Institute of Technology site.

Stage of Development:

Fully developed.

How To Acquire:

If you would like to receive credit for this course, please continue to the Air Force Institute of Technology site (http://www.afit.edu/).

Title: Level I Ergonomics Methodology Guide for Maintenance/Inspection Work Areas

Overall Category: Handbook/Course
Updated: September 2004
----------**Owner/Sponsor**
Organization: Air Force Institute for Operational Health
http://www.brooks.af.mil/afioh/Health%20Programs/ergonomics_mission.htm

Point of Contact Information:
SSgt Karl Giese
210-536-6118 DSN: 240-6118 FAX: 240-2315
karl.giese@brooks.af.mil

Product Specific Web Site: http://www.brooks.af.mil/afioh/Health%20Programs/ergonomics_publications.htm
(Note: this is a restricted site)

General Overview:
This Guide provides a methodology to allow technicians with minimal training in ergonomics to identify risk factors for work-related musculoskeletal disorders, select practical control methods, facilitate implementation of modifications, and measure the impact of improvements to U.S. Air Force maintenance/inspection workplaces.

It enables identification and control of risk factors associated with the development of work-related musculoskeletal disorders in workers employed in maintenance/inspection (industrial) work areas. Output (list of risk factors and possible corrective actions) can be provided to work area supervisors for consideration/implementation.

Input/Output/Processing:
User completes Level I Ergonomics Assessment Checklist based on observation of work activities and discussions with workers and supervisors.

Checklist provides scoring algorithm for establishing corrective action priorities for risk factors identified using the Checklist.

Results of assessment indicate whether the job presents risk factors for musculoskeletal disorder development. If yes, the results indicate what part(s) of the job is the primary source of risk factors, and what part(s) of the body should be targeted when identifying controls/job improvements. The methodology also enables the user to match hazards identified during the assessment to controls that can reduce or eliminate the hazards.

Documentation:
AL/OE-TR-1996-0158 V. 4A, "Preventing Work-Related Musculoskeletal Illnesses Through Ergonomics: The Air Force PREMIER Program, Volume 4A: Level I Ergonomics Assessment Methodology Guide for Maintenance/Inspection Work Areas"

Alternative/Comparable Approaches:
Although many checklists/approaches have been developed to identify risk factors associated with work-related musculoskeletal disorders (e.g., OSHA, 1995; Keyserling, et al., 1993), none lead the user through the complete risk factor abatement process (identification of risk factors, evaluation of severity, development of potential controls).

Stage of Development:
Complete

Date Current Version Released:

May 1997

Validation:
Formal testing and validation efforts are documented in: AL/OE-TR-1996-0158 V. 4B, "Research Report for Level I Ergonomics Assessment Methodology Guide for Maintenance/Inspection Work Areas".

Comments:
Can be downloaded from AF Ergonomics Online Website, which is a secure site with access limitations.

How To Acquire:
Point of Contact listed above.

Title: MANPRINT Guidebook for Systems' Design and Assessment

Overall Category: Handbook/Course
Update: August 2004

Owner/Sponsor Organization: Headquarters Department of the Army (HQDA), Army-G1, MANPRINT Directorate
http://www.manprint.army.mil/

Point of Contact Information:

Ms. Teresa Hanson
703-695-5848 DSN: 225-5848 FAX: 703-695-6997
teresa.hanson@hqda.army.mil

General Overview:
Guidebook provides MANPRINT domain experts, program managers, and requirements offices/concept developers with checklists of domain-specific items covering possible design elements of analysis, features, and issues when participating in Integrated Concept Teams, Integrated Product Teams, in test planning, and when assessing a system.

This paper tool is intended to be a training aid for the new MANPRINT practitioner, and a convenient reminder checklist for an experienced MANPRINT assessor. It provides a detailed domain-specific listing of what one should look for in assessing a system. As such, the checklist makes up a comprehensive rating guide and gives the practitioner a feel for the topical coverage of each domain.

Input/Output/Processing:
Basis for domain assessments.

Stage of Development:
Completed.

Comments:
Paper copy is 33 pages; also available electronically as a word document.

How To Acquire:
Point of Contact listed above.

Title: National Plan for Civil Aviation Human Factors: An Initiative for Research and Application

Overall Category: Handbook/Course
Update: May 2004

Owner/Sponsor Organization: Federal Aviation Administration
http://www.hf.faa.gov/

Point of Contact Information:

Dr. Mark Rodgers
202-267-7219
mark.rodgers@faa.gov

Product Specific Web Site:
http://www.hf.faa.gov/faa.htm

General Overview:
The purpose of the National Plan for Civil Aviation Human Factors is to describe the human factors actions required by the aviation community to achieve and maintain the world's safest and most efficient National Airspace System (NAS). It provides a framework for the aviation community to initiate research and management activities to produce and use technical findings. Two goals are paramount - reducing error in human-system interactions and increasing the efficiency of human-system performance.

Attaining these goals requires the following four iterative activities:

1. Identifying operational needs and problems involving human performance.
2. Guiding research programs in federal organizations to address operational priorities.
3. Eliciting the participation of the nation's top scientists and aviation professionals in government, industry, and universities.
4. Facilitating transfer of research results to the operational community.

The plan outlines a coherent national agenda containing two major elements. The first element focuses on five research thrusts:

1. Human-centered automation.
2. Selection and training.
3. Human performance assessment.
4. Information management and display.
5. Bioaeronautics.

The second element focuses on opportunities for improving the application of research results to planned and ongoing programs. Implementation of four manage actions is outlined:

1. Establish and implement the policies and processes necessary to an environment for change.
2. Develop human factors education and training programs at all levels.
3. Equip personnel and facilities with modern tools and techniques of the human factors engineering discipline.
4. Develop and maintain the infrastructure to translate and disseminate human factors products, and guide the organization's functions involving the human component.

The National Plan is used for design and implementation of Human-System Integration programs. It is used to provide the structure for institutionalizing the consideration of human performance issues and reducing many of the operationally significant human performance challenges facing the nation's aviation system. The National

Plan is used to promote coordination between governmental departments and organizations; and between government, private industry and academia.

Documentation:
National Plan for Civil Aviation Human Factors, March 1995.

Stage of Development:
The original Plan was published in November 1990. This update to the Plan, published in March 1995 is completed.

Date Current Version Released:
March 1995

Validation:
The concepts of the National Plan for Civil Aviation Human Factors have guided the annual development of research and engineering activities since 1990.

Comments:
The National Plan emphasizes human performance from a NAS perspective where the system encompasses the broadest interests of the aviation community including flight deck, aircraft cabin, air traffic control, airway facilities, aircraft maintenance, and commercial and general aviation operations, as well as the regulatory and organizational activities affecting these elements. This initiative describes the contributions of NASA, FAA, and DoD, along with structured recommendations from the private sector of the aviation community. It addresses research needs and required implementation activities arising from discussions within the public and private sectors of the aviation community.

How To Acquire:
URL listed above or Point of Contact listed above.

Title: NATO Guidelines on Human Engineering Testing and Evaluation

Overall Category: Handbook/Course
Updated: August 2004

Owner/Sponsor Organization: RTO-TR-021 AC/323(HFM-018)TP/19, Human Engineering Testing and Evaluation
http://www.nato.int/

Point of Contact Information:

Geddie & Associates
Dr. James C. Geddie
254-698-6405
geddie@usa.com

General Overview:
NATO Research Study Group 24, Human Engineering and Evaluation (RSG.24) developed a set of NATO-sanctioned guidelines for performing human engineering testing and evaluation.

The document addresses five data categories:
Workload, Test Participant Characteristics, User Subjective Judgment, Engineering Measurement, and Human Task Performance. One of the agreements among members at the beginning of the Group effort was that the methodology and technology recommended in the guidelines must be widely used and recognized by all member nations. That restriction essentially precluded incorporation of any recent or cutting-edge technology; so proceedings from a workshop held in June, 1997, at NATO HQ in Brussels provide a way to address that shortcoming. The proceedings of the workshop were published as a stand-alone document, but should be considered for inclusion in any future revisions of the guidelines.

The purpose of the guidelines is to try to make more efficient use of test data to support purchase decisions, co-development, co-production, and other cooperative ventures among NATO nations. If properly used, the guidelines identify and provide information on methods and procedures that are generally recognized and used by NATO weapons-producing nations in doing human engineering testing and evaluation, and will facilitate using each other's data to avoid duplicative testing, and to help NATO and other purchasers be better shoppers.

Equipment/Software Required:
T&E generic.

Input/Output/Processing:
T&E generic.

Documentation:
T&E generic.

Stage of Development:
Complete.

Validation:
Approved by NATO.

How To Acquire:
U.S. Distribution Center
NASA Center for AeroSpace Information (CASI)
Parkway Center

Title: RAC-HDBK-1190: HUMAN - A Practical Guide to Developing Reliable Human-Machine Systems and Processes

Overall Category: Handbook/Course
Updated: July 2004

Owner/Sponsor Organization: Defense Technical Information Center (DTIC)
http://rac.alionscience.com

Point of Contact Information:

Mr. Ned Criscimagna, RAC Deputy Director
301-918-1526
ncriscimagna@alionscience.com

Product Specific Web Site:
http://rac.alionscience.com/rac/jsp/webproducts/products.jsp?detail=HUMAN

General Overview:
RAC-HDBK-1190: An important element in the level of reliability achieved in the field and the cost of support is the human. The role of humans in system and process design and operation has long been a subject of study for engineers, psychologists, and efficiency experts. These studies in large measure, however, have simply sought to improve the way in which the human interacted with machines. Other studies, such as those dealing with anthropometrics, are limited to designing for the physical capabilities and limitations of the human. Few specifically addressed the relationship between the human element and system or process reliability. Although textbooks on human reliability and related topics (e.g., engineering psychology, human factors, and human physiology) have been written, no easy-to-use guidebook focusing on developing reliable human-machine systems and process has been available.

This new guide from the RAC:
* Helps designers consider the impact of humans early in the development of systems and processes.
* Is a bridge between introductory tutorials and short courses on human factors and human reliability and more extensive texts on human factors.
* Provides a highly understandable and readily accessible source of human factors and human reliability information.

Equipment/Software Required:
WWW access, phone, or fax.

Documentation:
Product Specific Web Site above.

Alternative/Comparable Approaches:
Information Analysis Centers (IAC) are DoD-sponsored centers which provide scientific, technical, and support services to government, industry, and academic communities. Each IAC serves a vital technical or mission area.

Stage of Development:
Available.

Date Current Version Released:
2003

How To Acquire:
Online at: http://rac.alionscience.com/rac/jsp/webproducts/products.jsp

Phone: 31-888-RAC-USER; FAX: 315-337-9932

Title: Training #2: HSI Relationship Tool

Overall Category: Handbook/Course
Updated: May 2004

Owner/Sponsor Organization: 311th Human Systems Wing - Acquisition and Environmental Planning
http://www.brooks.af.mil/HSW/

Point of Contact Information:

Mr. Adrian O. Salinas
210-536-4428 DSN: 240-4428 FAX: 210-536-4475
adrian.salinas@brooks.af.mil

General Overview:
The HSI Relationship Tool is a workshop-style course where students learn tradeoff decisions during the acquisition process for a weapon system.

The HSI Relationship Tool provides an overall explanation of the nine HSI domains that the Air Force considers, a more detailed explanation of each HSI domain, and a visual demonstration of the inter-relationship of one domain to the remaining domains. In addition, fictitious weapon system scenario exercises are provided which allows the student to determine how the depicted domains are affected by the other domains in question with the scenario provided.

Stage of Development:
Fully developed.

Validation:
Course is not yet AFIT accredited.

How To Acquire:
Within the Knowledge Now website: https://afkm.wpafb.af.mil/ASPs/CoP/EntryCoP.asp?Filter=HP-HS

Click on “Understanding HSI Relationship” on the right hand side of the web page. You do not need a password to enter this training course.

Point of Contact listed above.

STANDARDIZATION DOCUMENTS

Title: DOD-HDBK-743A, Anthropometry of U.S. Military Personnel

Overall Category: Standardization Document
Updated: July 2004

Owner/Sponsor Organization: U.S. Army Soldier, Biological and Chemical Command Natick Soldier Center
http://www.natick.army.mil/

Point of Contact Information:

Mr. Steve Paquette
U.S. Army Natick Soldier Center
508-233-5430 DSN: 256-5430 FAX: 508-233-5523
steven.paquette@natick.army.mil

General Overview:

Presents body size information on the military personnel of the United States in the form of anthropometric data. Introductory material describes uses of the data, importance of military anthropometry, availability of military anthropometric data, and previous publications of such data. An extensive summary of sources is provided, including fifteen major anthropometric surveys, five anthropometric studies of specific body parts, and fifteen other anthropometric surveys and studies. Brief definitions and illustrative figures describe 203 body measurements. Over 400 pp of statistical and percentile values for the 203 (nude) body measurements form the major portion of the handbook. (546 pp)

Used for human factors engineering applications in the design and development of military systems, equipment, and facilities and in the design and sizing of military clothing and personal equipment. The anthropometric data included in MIL-HDBK-759C are limited to only the 5th and 95th percentile values for selected body dimensions. This handbook not only serves as a supplement to MIL-HDBK-759C as a source of anthropometric data, it presents it in sufficient detail, and in a format readily usable by those who require body size information for design, sizing, and human engineering purposes. Essentially, DOD-HDBK-743A is the authoritative Defense standardization source of such data. DOD-HDBK-743A is intended for guidance only, not for citation as a contractual requirement. If it is cited contractually, the contractor is not obligated to comply with its provisions.

Alternative/Comparable Approaches:

As noted above, some anthropometric data are included in MIL-HDBK-759C and are limited to only the 5th and 95th percentile values for selected body dimensions. That source can be entirely satisfactory for application to simple design problems involving physical access and clearance where system performance requirements are expressed in terms of operability by users with applicable 5th and 95th percentile body dimensions. Where such problems involve measurements not contained in MIL-HDBK-759C, or where system requirements focus on ranges other than the 5th through 95th percentiles, that and similar documents may not be suitable as anthropometric data sources. A summary of other approaches would probably be too extensive to appear here; however, as a general observation, alternatives could include using data from anthropometric surveys, some of which served as sources of data contained in the handbook. A bibliography of such sources appears in the handbook. Data is also available in tape form that has been prepared for the Armstrong Laboratory at Wright-Patterson Air Force Base, OH, and are available from DTIC. Most of these could be considered as archival, since they reflect data banks from 1946-1977 surveys. More recent data in electronic form is available via computerized tools and techniques summarized elsewhere in this Directory.

Stage of Development:

This is a mature handbook.

Date Current Version Released:

Revision A, approved 13 February 1991, is the current edition.

Validation:
Required February 1996.

Comments:
Document location: Mr. Steve Paquette
U.S. Army Natick Soldier Center
Ergonomics Team
Kansas Street
Natick, MA 01760
508-233-5430; DSN 256-5430; FAX 508-233-5523
email: steven.paquette@natick.army.mil

How To Acquire:
See “Ordering Information” under “Standardization Documents-General Information" at the front of the DDSM.

Title: Human Engineering Design Data Digest

Overall Category: Standardization Document
Update: May 2004

Owner/Sponsor Organization: DoD Human Factors Engineering Technical Advisory Group (DoD HFE TAG)
http://hfetag.dtic.mil/

Point of Contact Information:

Mr. Alan Poston, Chair, HFS SubTAG
Human Factors Standardization SubTAG
202-493-5419
alan.poston@faa.gov

Product Specific Web Site:
http://hfetag.dtic.mil/docs/pocket_guide.doc

General Overview:
This digest provides basic, quantitative human engineering design data in pictorial, tabular, and graphical formats for use during system, equipment, or facility design and assessment. Its purpose is to furnish a convenient "portable" reference of human engineering design criteria and guidelines. The principles, explanations, limitations, and application techniques associated with the data have been intentionally omitted. This abbreviated presentation presupposes that the user is familiar with the bases and limitations of the given data or will consult applicable references to ensure appropriate application of the data.

This digest is a summarization of material appearing in MIL-STD-1472, and is complemented with material from MIL-HDBK-759 and the Federal Aviation Administration (FAA) Human Factors Design Guide. The user is, therefore, referred to those documents and its references for required supplementary information.

Documentation:
MIL-STD-1472, Human Engineering
MIL-HDBK-759, Human Engineering Design Guidelines
DOT/FAA/CT-96/1, Human Factors Design Guide

Alternative/Comparable Approaches:
Documentation directly from the appropriate standards, handbooks, and guides.

Stage of Development:
This is the initial document produced under the auspices of the DoD HFE TAG.

Date Current Version Released:
April 2000.

Comments:
Neither the technical Point of Contact (POC) listed above for this Index, nor the distributing POC listed, can provide any of the source documents.

How To Acquire:
The electronic version of the document can be downloaded from the Product Specific Web Site listed above. A hard copy can be obtained from: Teresa Alley, MATRIS Office, Defense Technical Information Center, NAS North Island, Box 357011, San Diego, CA 92135-7011; (619) 545-7384; talley@dticam.dtic.mil

Title: Human Factors Design Standard (HFDS)

Overall Category: Standardization Document
Updated: July 2004

Owner/Sponsor Organization: FAA William J Hughes Technical Center
http://acb220.tc.faa.gov/

Point of Contact Information:

Ms. Vicki Ahlstrom (HFDS Program Lead)
609-485-5643 FAX: 609-485-6218
vicki.ahlstrom@faa.gov

Product Specific Web Site:
http://acb220.tc.faa.gov/hfds/default.htm

General Overview:
This reference document provides design guidance information for human factors professionals to use to select, analyze, design, develop, and evaluate new and modified FAA systems and equipment. The purpose of this document is to provide a single easy-to-use source of human factors design criteria, oriented to the needs of the FAA mission and systems. An additional goal is to facilitate use of appropriate design criteria by organizing the document so that users can easily locate the needed information.

The HFDS covers a broad range of human factors topics including automation, maintenance, displays and printers, controls and visual indicators, audio, alarms and voice, computer human interface, input devices, workplace and workstation design, system security, personnel safety, environment, anthropometry and biomechanics, and documentation.

The HFDS replaces and expands upon the Human Factors Design Guide (HFDG) published in 1996 and all HFDG chapter updates. The HFDS broadens the focus to include both air traffic and airway facilities systems and has been modified into a set of standards instead of a set of guidelines, providing a common source of FAA-specific design requirements. The resulting set of standards can be tailored to meet the needs of the system or program at hand.

Equipment/Software Required:
No special equipment is necessary to use this document. The document is in PDF format and requires Adobe Acrobat reader, which can be downloaded for free from the internet. There is currently a CD-ROM version available, requiring CD-ROM capability.

Documentation:
Self-contained.

Alternative/Comparable Approaches:
Complements Human Factors selection, development, and evaluation processes.

Stage of Development:
Initial version of the document is completed. The chapter on input devices will be superseded in the near future by two new chapters, one on keyboards and one on non-keyboard interaction devices.

Date Current Version Released:
2003

Validation:

Has had broad review by selected human factors experts.

Comments:
This standard is user-friendly, and consolidates a great deal of information from many sources.

How To Acquire:
Point of Contact listed above. Alternate POC: Dr. Earl Stein (ATHF Program Manager), 609-485-6389. Also downloadable from the website.

Title: Index of Non-Government Standards on Human Engineering Design Criteria and Program Requirements/Guidelines

Overall Category: Standardization Document
Updated: August 2004

Owner/Sponsor Organization: DoD Human Factors Engineering Technical Advisory Group (DoD HFE TAG)
http://hfetag.dtic.mil/

Point of Contact Information:

Mr. Alan Poston, Chair, HFS SubTAG
Human Factors Standardization SubTAG
202-493-5419
alan.poston@faa.gov

Product Specific Web Site:
http://hfetag.dtic.mil/docs/index_ngs.doc

General Overview:
This 30-page tabulation of over 450 current HFE non-government standards (NGS) lists the subject area covered by the standard (e.g., machinery, color and marking), title of the standard, various document identifiers (which includes the standards body responsible), and organizational addresses and website links of those standards bodies. The listing identifies those NGSs cited by DoD HFAC documents, those adopted by DoD, and those available through the NASA Technical Standards Program.

Document selection for this index is a function of how one defines "human engineering," "human factors," "ergonomics," and "standard." Some non-human factors documents, cited by human factors standards, appear in the list and include general documents (e.g., metric system usage) and focused documents (e.g., acoustical measurements).

As a general rule, standards focused on human performance, effects, or exposure were included; standards aimed at equipment were not, unless the equipment might be used by military personnel for mission accomplishment, or involves measuring devices/instrumentation used in human factors testing.

Since the designation of documents as standards by non-government standards bodies tend to be somewhat flexible, the scope of the listing has been kept quite loose and includes standards, specifications, recommended practices, codes, guides, handbooks, etc. For those documents not specifically identified as standards, the general guideline for inclusion in this index was that they are written in the manner of standards; i.e., they contain provisions with traditional action verbs (shall/should/may). Others were prepared by standards organizations, and, presumably, proceeded through a recognized due process-type procedure for consensus acceptance. The Index was also limited to documents designated by numbered identifiers.

Draft standards are listed separately. These standards have not yet been approved, and it is possible that agreement may never be reached. Furthermore, draft standards may be difficult to obtain. This listing provides some information on work in progress, however, the reader is cautioned to check the current status before use.

This index can be used as a comprehensive, but not all-inclusive, list of human factors standardization documents for overview purposes, or for ordering a specific document by using its identifier in the main listing to determine its source and consulting an organization address listing provided at the end of the Index.

Documentation:
In addition to well-known and currently used standards, representative sources for this Index included
- DoD Index of Specifications and Standards

- Non-government standards referenced in HFAC standards and handbooks, databases, and standards organizations' catalogs

Alternative/Comparable Approaches:
Internet searches of databases and standards organizations' catalogs.

Stage of Development:
Version 1 of the Index was produced by the Technical Society/Industry (TS/I) sub-TAG of the DoD HFE TAG, was submitted to, and accepted by, the TAG Operating Board, 7 Nov. 1995. Version 2 was prepared by the TS/I SubTAG and submitted to the DoD HFE TAG Operating Board on 13 May 1997.

The current version (Version 3) is a joint product of the Human Factors Standardization SubTAG and the TS/I.

Date Current Version Released:
October 2002.

Comments:
Neither the technical Point of Contact (POC) listed above for this Index, nor the distributing POC listed, can provide any of the source documents.

How To Acquire:
The electronic version of the document can be downloaded from the Product Specific Web Site listed above.

Title: Joint Service Specification Guide 2010, Crew Systems

Overall Category: Standardization Document
Updated: August 2004

Owner/Sponsor Organization: Joint Service
https://www.en.wpafb.af.mil/ (restricted web site)

Point of Contact Information:

Mr. Victor Santi
Aeronautical Systems Center, ASC/ENFC
937-255-5797 DSN: 785-5797 FAX: 937-255-8063
vic.santi@wbafb.af.mil

Product Specific Web Site:
http://engineering.wpafb.af.mil/engstds/jssg.asp

General Overview:
JSSG-2010, Crew Systems, is a specification guide that should be used in developing aircraft specifications dealing with the cockpit/crew station.

JSSG-2010 contains specifications, guidance, rationale, and verification information for all aspects of the aircraft crew systems. These include pilot vehicle interface/human factors, life support, escape, and lighting systems.

Equipment/Software Required:
The specification is distributed on CD and runs in Adobe Reader.

Stage of Development:
Current and available for limited distribution.

Date Current Version Released:
Dated 1 May 2000.

Comments:
Joint Service Specification Guide 2010, Crew Systems, is a tri-service document that that is distributed by ASC/EN, USAF. The JSSG has a limited distribution to US government agencies and their contractors. The Point of Contact (POC) listed above is the technical POC.

How To Acquire:
http://engineering.wpafb.af.mil/engstds/jssg.asp

Title: MIL-HDBK-759C, Department of Defense Handbook for Human Engineering Design Guidelines

Overall Category: Standardization Document
Updated: August 2004

Owner/Sponsor Organization: Army Aviation and Missile Command
http://www.redstone.army.mil/newAMCOM.htm

Point of Contact Information:

Mr. Lee Gray
256-876-6980 DSN: 746-6980
lee.gray@rdec.redstone.army.mil

Product Specific Web Site:
http://hfetag.dtic.mil/hfs_docs.html

General Overview:
This handbook provides basic guidelines and data on human engineering design for military systems, equipment, and facilities, and was designed to supplement MIL-STD-1472 (see entry for MIL-STD-1472E). To cue the MIL-STD-1472E user to such supplementary information, this handbook has been formatted to follow the same paragraph numbering, down to the third indenture level, as in MIL-STD-1472E, e.g. paragraph 5.4.5 of both MIL-STD-1472E and MIL-HDBK-759C deal with miniature controls. Some paragraphs, necessarily, do not contain any information, but are reserved to accommodate new information that may become available. Additional paragraphs are added to accommodate information that does not appropriately fit elsewhere. (364 pp)

The handbook is intended to provide human engineering guidelines, preferred practices, and reference data for design of military materiel, both in-house and contracted, to facilitate achieving objectives stated in DoD and Service human engineering policy documents. The handbook also serves to provide expanded, supplementary, and relevant human engineering information that may be too detailed, lengthy, or service-oriented for inclusion in standards, such as MIL-STD-1472. MIL-HDBK-759C is intended for guidance only, not for citation as a contractual requirement. If it is cited contractually, the contractor is not obligated to comply with its provisions.

Handbook provides human engineering guidelines for direct application to design.

Alternative/Comparable Approaches:
Numerous handbooks, guidelines, and texts are available for application to general design problems. An example of a handbook focused on military systems, equipment, and facilities is the Human Engineering Guide to Equipment Design, H.P. Van Cott and R.G. Kinkade, eds., Wiley, 605 Third Ave., New York, NY 10158, 1972, (Library of Congress Catalog Card No. 72600054).

Stage of Development:
This is a mature handbook. Revision C is the current edition. See COMMENTS below.

Date Current Version Released:
Approved 31 July 1995 (including Change Notices 1 and 2, approved 28 Feb. 1997 and 31 Mar. 1998, respectively).

Validation:
Not required until July 2000.

Comments:

Change Notice 1, approved 28 Feb. 1997, was issued exclusively to move anthropometric tables and figures from MIL-STD-1472 to MIL-HDBK-759C. Change Notice 2, approved 31 Mar. 1998, was issued to incorporate and update Table XXVI, Typical Fighting and Existence Loads (Temperate Zone), that was removed from MIL-STD-1472E.

A change notice or revision may be initiated in late 1998 to incorporate applicable material from the Air Force Design Handbook DH 1-3, Human Factors Engineering, that has been inactive for several years.
Technical point of contact:

Mr. Tom Cook, ARL Field Element - AMCOM
Voice: 256-842-9557 / DSN 746-9557
Fax: 256-842-9451
E-mail: thomas.cook@rdec.redstone.army.mil

How To Acquire:
See URL above or “Ordering Information” under “Standardization Documents-General Information" at the front of the DDSM.

Title: MIL-HDBK-767, Design Guidance for Interior Noise Reduction in Light-Armored Tracked

Overall Category: Standardization Document
Update: July 2004

Owner/Sponsor Organization: US Army Tank-Automotive and ARMAMENTS Command
http://www.tacom.army.mil/main/index.html

Point of Contact Information:

Kurt Hogue
586-753-2442 DSN: 786-2442 FAX: 586-574-5666
hoguek@tacom.army.mil

General Overview:
This handbook gives proven guidelines for designing quiet tracked vehicles and reducing interior noise by redesigning vehicle components. The guidelines primarily focus on track and suspension components; additional guidelines are provided for designing a quiet hull and engine enclosure. (86 pp)

The handbook provides design guidance for interior noise reduction of light-armored tracked vehicles weighing less than 30 tons. These guidelines may be applicable for heavier vehicles but have been validated only for weights less than 30 tons. The guidelines are suitable for new vehicle designs, as well as redesign of existing vehicles. The intended audience includes: 1) designers of combat vehicles who are seeking guidance in designing inherently quieter tracked vehicles; 2) vehicle project and product managers who are seeking an overview of the importance of interior noise reduction and how to achieve it; and 3) military officers who are part of the procurement or development community, and who are seeking tradeoff information on the difficulty, expense, impact, and advantages of designing quieter tracked vehicles. DOD-HDBK-767 is intended for guidance only, not for citation as a contractual requirement. If it is cited contractually, the contractor is not obligated to comply with its provisions.

Stage of Development:
Approved and available.

Validation:
Validated April 2004.

Comments:
Technical POC: Doug Hedberg

TACOM
AMSTA-TR-R, MS159
6501 E. 11 MILE
Warren, MI 48397-5000
586-574-8675
hedbergd@tacom.army.mil

How To Acquire:
See URL above or "Ordering Information" under "Standardization Documents-General Information" at the front of the DDSM.

Title: MIL-HDBK-1473A, Color and Marking of Army Materiel

Overall Category: Standardization Document
Update: August 2004

Owner/Sponsor Organization: Army Aviation and Missile Command
http://www.redstone.army.mil/newAMCOM.htm

Point of Contact Information:

Mr. Lee Gray
256-876-6980 DSN: 746-6980
lee.gray@rdec.redstone.army.mil

General Overview:

Consolidates into a single document color and marking guidelines for different classes of materiel contained in numerous administrative and standardization documents. The handbook establishes general guidelines and serves as a convenient summary of color and marking practices (commodity and functional) as they apply to Army materiel. General color provisions of the handbook address controls and displays, and off-the-shelf equipment. General marking provisions address identification, shipment and storage, controls and displays, and labeling, lettering, and numeral design. Detailed provisions are largely weapon-oriented, e.g., towed artillery, multiple rocket launchers, missiles, rockets, missile ground support equipment, and small systems. Color and marking provisions also address meteorological equipment, machine tools, petroleum and related products, photographic and audio-visual equipment, and other diverse items. Functionally oriented detailed provisions focus primarily on safety signs. (34 pp)

The handbook provides guidance only for colors and markings -- not finishes, surface preparations, related treatments for preservation and coating, or special provisions specified by Army design activities. The handbook is not intended to apply to exterior colors of Army equipment under tactical conditions in active combat theaters of operation where such equipment may be painted Lusterless White in snow areas, or other colors or patterns deemed necessary for camouflage, or for compliance with host country requirements.

Alternative/Comparable Approaches:

Use of the guidance documents (specifications, administrative documents, such as regulations and non-government standards), listed in the appendix, which served as sources for some of the provisions in the handbook.

Stage of Development:

Approved and available.

Validation:

Not required until August 2002.

Comments:

Technical point of contact: Mr. Tom Cook, ARL Field Element - AMCOM
Voice: 256-842-9557 / DSN 746-9557
Fax: 256-842-9451
E-mail: thomas.cook@rdec.redstone.army.mil

How To Acquire:

The distribution of MIL-STD-1473A is limited to DoD employees and to those on the Defense Logistics Services Center's list of certified DoD Contractors (see “Ordering Information” under “Standardization Documents-General Information" at the front of the DDSM).

Title: MIL-HDBK-1908B, Definitions of Human Factors Terms

Overall Category: Standardization Document
Updated: August 2004

Owner/Sponsor Organization: Army Aviation and Missile Command
http://www.redstone.army.mil/newAMCOM.htm

Point of Contact Information:

Mr. Lee Gray
256-876-6980 DSN: 746-6980
lee.gray@rdec.redstone.army.mil

Product Specific Web Site:
http://hfetag.dtic.mil/hfs_docs.html

General Overview:
This handbook consolidates definitions of terms used in Defense human factors standardization (HFAC) documents by providing common meanings of such terms to ensure that they will be interpreted consistently and in the manner intended, thereby eliminating overlap, duplication, and conflict. As other HFAC documents were revised, they dropped the contents of their "Definitions" sections in favor of this handbook.

The "A" revision of this handbook (1) incorporated terms and definitions of MIL-STD-1789A, "Sound Pressure Levels in Aircraft," (not in the human factors standardization area), since that standard was consolidated into MIL-STD-1474D; (2) deleted terms and definitions that had been drawn from standards that have since been canceled; and cited additional non-government standards as supplemental sources.

Each term appears alphabetically, in bold face, followed by an italicized annotation of the application to which the definition was created to support; i.e., (1) general human engineering applications, (2) user/computer interface, (3) sound, noise, vibration, (4) display symbol information, and (5) acquisition. The definition that follows each boldfaced and annotated term does not apply to other applications. (42 pp).

Provides users of human factors standardization documents with definitions of human factors terms used therein; provides preparers of human factors standardization documents with definitions of terms to ensure that such terms in new documents will harmonize with accepted usage. DOD-HDBK-1908A is intended for guidance only, not for citation as a contractual requirement. If it is cited contractually, the contractor is not obligated to comply with its provisions.

Alternative/Comparable Approaches:
Dictionaries (traditional and technical) could be used with some risk. The definitions contained in such dictionaries may differ from those in MIL-HDBK-1908, since the latter were carefully developed to support the meanings and contexts of what had been contractually binding provisions in the original source standards.

Stage of Development:
Available.

Date Current Version Released:
Approved 16 Aug 1999.

Validation:
Not required until June 2001.

Comments:

Technical POC: Mr. Tom Cook, ARL Field Element - AMCOM
Voice: 256-842-9557 / DSN 746-9557
Fax: 256-842-9451
E-mail: thomas.cook@rdec.redstone.army.mil

How To Acquire:
See URL above or “Ordering Information” under “Standardization Documents-General Information" at the front of the DDSM.

Title: MIL-HDBK-46855A, Department of Defense Handbook: Human Engineering Program Process And Procedures

Overall Category: Standardization Document
Updated: August 2004

Owner/Sponsor Organization: Army Aviation and Missile Command
http://www.redstone.army.mil/newAMCOM.htm

Point of Contact Information:

Mr. Lee Gray
256-876-6980 DSN: 746-6980
lee.gray@rdec.redstone.army.mil

Product Specific Web Site:
http://hfetag.dtic.mil/hfs_docs.html

General Overview:
Describes the application of human engineering to the development and acquisition of military systems, equipment, and facilities, including work accomplished by a contractor or subcontractor in conducting a human engineering effort integrated with the total system engineering and development effort. Provides guidance for including human engineering in proposals, and in system, equipment, software, and facility analysis, design, and test. (32 pp)

When used, this handbook should be tailored for application to specific programs and the milestone phase of the program within the overall life cycle. The tailoring selectively applies methods, tables, sections, individual paragraphs or sentences, or a combination thereof, to identify important human engineering program actions consistent with avoiding unnecessary program costs. Tailoring guidance is contained in an Appendix. The handbook also provides a basis for respondents to make requests for proposals to provide human engineering program information.

Also see COMMENTS, below.

Stage of Development:
Available. See COMMENTS below.

Date Current Version Released:
Approved 31 January 1996.

Validation:
Not required until May 1999; however, see COMMENTS, below.

Comments:
MIL-HDBK-46855, 21 January 1996, Department of Defense Handbook: Human Engineering Guidelines for Military Systems, Equipment, and Facilities, replaced MIL-STD-46855, 29 May 1994, Human Engineering Requirements for Military Systems, Equipment, and Facilities. MIL-HDBK-46855 consists of MIL-STD-46855 with a new cover sheet. The content of MIL-HDBK-46855 is being revised and combined with DOD-HDBK-763. The consolidated handbook, MIL-HDBK- 46855A, is expected to appear in coordination draft form during the Summer of 1998. The content of MIL-HDBK-46855 is expected to appear in the revision as Section 4, Program Tasks, and as appendices. Upon approval of MIL-HDBK-46855A, MIL-HDBK-46855 will be canceled, probably in late 1998 or early 1999.

Technical point of contact:

Mr. Tom Cook
ARL Field Element - AMCOM
Voice: 256-842-9557 / DSN 746-9557
Fax: 256-842-9451
E-mail: thomas.cook@rdec.redstone.army.mil

How To Acquire:
See URL above or “Ordering Information” under “Standardization Documents-General Information" at the front of the DDSM.

Title: MIL-STD-1472F, Department of Defense Design Criteria Standard: Human Engineering

Overall Category: Standardization Document
Updated: August 2004

Owner/Sponsor Organization: Army Aviation and Missile Command
http://www.redstone.army.mil/newAMCOM.htm

Point of Contact Information:

Mr. Lee Gray
256-876-6980 DSN: 746-6980
lee.gray@rdec.redstone.army.mil

Product Specific Web Site:
http://hfetag.dtic.mil/hfs_docs.html

General Overview:
Establishes general human engineering criteria for design and development of military systems, equipment, and facilities to 1) achieve required performance by operator, control, and maintenance personnel, 2) minimize skill and personnel requirements and training time, 3) achieve required reliability of personnel-equipment/software combinations, and 4) foster design standardization within and among systems. Is probably the best known human engineering design standard in the U.S. MIL-STD-1472E contains brief, general requirements for standardization, function allocation, human engineering design, fail-safe design, interaction, safety, ruggedness, design for NBC survivability, and design for electromagnetic pulse (EMP) hardening. It also contains extensive, detailed requirements for control/display integration, visual displays, audio displays, controls, labeling, workspace design, design for maintainer, design of equipment for remote handling, small systems and equipment, operational and maintenance ground/shipboard vehicles, hazards and safety, aerospace vehicle compartments, user-computer interface, and visual display terminals. (198 pp)

Standard is used to contractually specify human engineering design criteria for detailed design phases such as engineering and manufacturing development. For earlier development, such as demonstration and validation, MIL-STD-1472E is used as a guide. A waiver is required prior to contractual citation as a requirement.

MIL-STD-1472E is essentially self-tailored, since criteria are in effect only to the degree that they apply to hardware or software being designed. Nothing in the standard limits the selection of hardware, materials, or process to the specific items therein. It is not intended to be a criterion for limiting use of materiel already in the field in areas such as lift repetition or temperature exposure time. Finally, when manufacturing tolerances are not perceptible to the user, MIL-STD-1472 does not prevent the use of components whose dimensions are within a normal manufacturing upper or lower limit tolerance of the dimensions specified. While MIL-STD-1472 was developed for use as a contractually invoked design standard, some individuals and organizations have used it as a handbook. Others have used it as a text.)

Alternative/Comparable Approaches:
Similar general human engineering design criteria standards are used or are available for applications outside the military product arena. In the government sector, NASA-STD-3000, Man-System Integration Standards (cited elsewhere) and DOE-STAND HFAC 1, Volume 1, General Criteria, are good examples; in the commercial sector, AAMI HE-48, Human Factors Engineering Guidelines and Preferred Practices for the Design of Medical Devices, is a good example. Several software packages have MIL-STD-1472 embedded, the example being Computer-Aided Systems Human Engineering (CASHE), described elsewhere herein.

The content of MIL-STD-1472 has also been adopted by a number of software packages (see Integrated Design/Engineering (IDEA) under Section 3, and Computer-Aided Human Engineering (CASHE) under Section 6).

Stage of Development:
Available.

Date Current Version Released:
23 Aug 1999

Validation:
Not required until 2001.

Comments:
As a result of implementing standardization reform, MIL-STD-1472D, "Human Engineering Design Criteria for Military Systems, Equipment, and Facilities," was revised as MIL-STD-1472E, "Department of Defense Design Criteria Standard: Human Engineering." While the technical integrity of the standard was maintained, the page count was reduced from 423 to 206, applicable documents were trimmed from 81 to 25 (almost half of which are non-government standards), all non-DoDISS document citations were removed, and over two dozen out-of-scope paragraphs were deleted. Moreover, over 600 changes were made to simplify and clarify, changing many "shalls" to "shoulds", and deleting handbook data, out-of-scope provisions, superfluous index material, tasking and "how to" provisions, and ambiguities and redundancies. Some tasking or design requirements were changed to performance provisions where possible.

A technical revision of MIL-STD-1472E is expected to appear in coordination draft form (PROPOSED MIL-STD-1472F) in late 1998 or early 1999.

Technical point of contact: Mr. Tom Cook, ARL Field Element - AMCOM
Voice: 256-842-9557 / DSN 746-9557
Fax: 256-842-9451
E-mail: thomas.cook@rdec.redstone.army.mil

How To Acquire:
See URL above or “Ordering Information” under “Standardization Documents-General Information" at the front of the DDSM.

Title: MIL-STD-1474D, Department of Defense Design Criteria Standard, Noise Limits

Overall Category: Standardization Document
Update: August 2004

Owner/Sponsor Organization: Army Aviation and Missile Command
http://www.redstone.army.mil/newAMCOM.htm

Point of Contact Information:

Mr. Lee Gray
256-876-6980 DSN: 746-6980 FAX: 256-842-6119
lee.gray@rdec.redstone.army.mil

Product Specific Web Site:
http://hfetag.dtic.mil/hfs_docs.html

General Overview:
MIL-STD-1474D is a materiel design standard that provides specific noise limits and related requirements to equipment designers and manufacturers. These limits, which must not be exceeded if the materiel is to be acceptable, are intended to cover typical operational conditions. The limits evolved from considerations of hearing damage-risk, speech intelligibility, aural detection, state-of-the-art noise reduction, and government legislation. The maximum limits in the standard are more stringent than Occupational Safety and Health Administration (OSHA) standards (29 CFR 1910.95), and are applied to military materiel in lieu of OSHA standards. MIL-STD-1474D is a Department of Defense Design Criteria Standard in sectional format, structured as general requirements and individual requirements contained in the following seven sections: 1) steady-state noise, personnel-occupied areas; 2) aural nondetectability; 3) community annoyance; 4) impulse noise, personnel-occupied areas; 5) shipboard equipment noise; 6) fixed-wing aircraft noise; and 7) rotary-wing aircraft noise. (Appx 100 pp)

MIL-STD-1474D is also the source document for the following Data Item Descriptions (DID), also approved 12 Feb. 1997:

Noise Measurement Report, DI-HFAC-80938B
Equipment Airborne Sound Measurement Plan, DI-HFAC-80270A
Sound Test Failure Notification and Recommendation Report, DI-HFAC-80271A
Equipment Airborne Sound Measurements Test Report, DI-HFAC-80272A

DI-HFAC-80938B applies to Sections 1-4 (see above). The remainder apply to Section 5.

The standard applies to the acquisition and product improvement of all designed or purchased systems, subsystems, equipment, and facilities that emit acoustical noise. It is intended to address noise levels emitted during the full range of typical military conditions. The standard provides criteria for designing materiel having noise levels that: 1) minimize noise-induced hearing loss; 2) permit acceptable speech communication in a noisy environment; 3) minimize aural detection by an enemy; 4) minimize community annoyance; and 5) provide acceptable habitability of personnel quarters. A waiver is required prior to contractual citation as a requirement.

Alternative/Comparable Approaches:
None practical. Complying with MIL-STD-1474 is equivalent to complying with the design imperatives of applicable legislation (OSHA for maximum limits; EPA for community annoyance), regulations (DA PAM 40-501, Hearing Conservation, OPNAVINST 5100.23B, Navy Occupational Safety and Health (NAVOSH) Program Manual, and OPNAVINST 5100.19B, NAVOSH Program Manual for Forces Afloat, and AFR 161-35, Hazardous Noise Exposure (changed in 1995 to AFOSHSTD 48-19, Hazardous Noise Program), and standards (MIL-STD-1472 for communication criteria). Using these source documents for direct application to design and

testing would be a costly, inefficient approach, since their maximum limits are not directed at design, but at hearing conservation measures, and would have to be expanded and supplemented for design application. MIL-STD-1474 already accomplishes that end.

Stage of Development:
A current document.

Date Current Version Released:
Approved 12 Feb. 1997. Change Notice 1, approved 29 Aug. 1997, was issued to correct four paragraph citation errors.

Validation:
Not required until 2002.

Comments:
MIL-STD-1474D was prepared, as directed at the 19 Apr. 95 meeting of the Defense Standards Improvement Council, to consolidate the following noise standards into a single document: (1) MIL-STD-740-1, Airborne Sound Measurements and Acceptance Criteria of Shipboard Equipment; (2) MIL-STD-1294A, Acoustical Noise Limits in Helicopters; (3) MIL-STD-1474C, Noise Limits for Military Materiel; and (4) MIL-STD-1789A, Sound Pressure Levels in Aircraft. Since MIL-STD-1474D was approved, MIL-STD-740-1 and MIL-STD-1789A are being canceled, MIL-STD-1294A has already been canceled, and MIL-STD-1474C has been superceded by MIL-STD-1474D.

Technical Points of contact: Army: Mr. Tom Cook, ARL Field Element - AMCOM
Voice: 256-842-9557 / DSN 746-9557
Fax: 256-842-9451
E-mail: thomas.cook@rdec.redstone.army.mil

How To Acquire:
See URL above or “Ordering Information” under “Standardization Documents-General Information" at the front of the DDSM.

Title: MIL-STD-1477C, Interface Standard: Symbols for Army Defense Systems Displays (Metric)

Overall Category: Standardization Document
Updated: August 2004

Owner/Sponsor Organization: Army Aviation and Missile Command
http://www.redstone.army.mil/newAMCOM.htm

Point of Contact Information:

Mr. Lee Gray
256-876-6980 DSN: 746-6980
lee.gray@rdec.redstone.army.mil

General Overview:
This standard prescribes the physical characteristics of symbols and associated alphanumeric information for ground and air tracks, units/installations, control measures, and equipment for U.S. Army Combined Arms system displays which are generated by electronic, optic or infrared technology, and which present information in real time or near-real time. (100 pp)

The standard applies to the design of all U.S. Army Combined Arms system displays, and is tailored as required to meet individual system requirements. These systems include air defense, aviation, armor, infantry, fire support, intelligence and logistics systems. The symbols presented are intended for application to high-quality, calligraphically written, cathode-ray tube displays. The standard may be applied to other, flat-panel type displays if the provisions are modified to ensure that image quality provides legible symbols, modifiers, and alphanumerics. The symbology specified in the standard is not intended to be applied retroactively to existing system; however, any system product improvement program may implement the requirements of the standard.

Alternative/Comparable Approaches:
For some applications, administrative-type documents, such as FM 101-5-1, Operational Terms and Symbols, could be consulted; however, MIL-STD-1477C is more efficient to use, since it consolidates symbol requirements from several sources and is quite self-contained. A standardization document alternative is MIL-STD-2525, Common Warfighting Symbology, Version 1, 30 Sep 94; however, MIL-STD-2525 is in the Information Standards and Technology Standardization Area, rather than the Human Factors Standardization Area. This suggests that symbol selection may have involved other than human performance and usage bases. The symbols of MIL-STD-2525 were reportedly drawn from STANAGs 2019 (land symbols) and 4420 (maintainer). It is not clear if MIL-STD-1477 was used as a source. MIL-STD-2525 was reportedly developed by the Symbology Standards Management Committee, chaired by DISA, with representatives from the Services and agencies.

Stage of Development:
Available

Date Current Version Released:
Approved 30 Sep. 1996.

Validation:
Not required until September 2001.

Comments:
Technical point of contact: Mr. Tom Cook, ARL Field Element - AMCOM
Voice: 256-842-9557 / DSN 746-9557
Fax: 256-842-9451
E-mail: thomas.cook@rdec.redstone.army.mil

How To Acquire:
See “Ordering Information” under “Standardization Documents-General Information" at the front of the DDSM.

Title: MIL-STD-1787C, Aircraft Display Symbology

Overall Category: Standardization Document
Updated: September 2004

Owner/Sponsor Organization: ASC/ENFC, USAF
https://www.en.wpafb.af.mil/ (restricted web site)

Point of Contact Information:

Mr. Jim Kinzig
937-255-7138 DSN: 785-7138 FAX: 937-255-8063
james.kinzig@wpafb.af.mil

Product Specific Web Site:
http://engineering.wpafb.af.mil/engstds/stdsdocorder.asp

General Overview:
The document provides requirements for primary flight display symbology. Tactical symbology is also included.

This standard should be applied any time symbology is used in aircraft cockpits. For the Air Force, it describes the requirements that must be met for Air Force Flight Standards Agency endorsement of the Primary Flight Display.

Equipment/Software Required:
If distributed on CD, it will require a personal computer with a CD ROM drive installed.

Documentation:
MIL-STD-1787C was published in January 2001. Version "D" is expected in late 2002, and will include rotorcraft symbology. Copies can be requested through ASC/ENOI, Wright-Patterson AFB, OH 45433-7101

Stage of Development:
Current Standard.

Date Current Version Released:
January 2001

Comments:
Replaces MIL STD 1787B as of September 2000. MIL-STD-1787C is Distribution Statement D Distribution authorized to the Department of the Defense and DoD contactors only; contains critical technology.

How To Acquire:
See Product Specific Web Site above.

Title: NASA-STD-3000, Man-Systems Integration Standards (MSIS)

Overall Category: Standardization Document
Update: September 2004

Owner/Sponsor Organization: NASA-Johnson Space Center
http://www.jsc.nasa.gov/

Point of Contact Information:

Ms. Janis H. Connolly
281-483-2318 FAX: 281-483-1847
janis.connolly-1@jsc.nasa.gov

Product Specific Web Site:
http://msis.jsc.nasa.gov/

General Overview:
These standards provide specific user information to ensure proper integration of the human-system interface requirements with those of other aerospace disciplines. These human-system interface requirements apply to launch, entry, on-orbit, and extraterrestrial space environments. This document is intended for use by design engineers, systems engineers, maintainability engineers, operations analysts, human factors specialists, and others engaged in the definition and development of human space projects or programs.

The MSIS incorporates human engineering standards and guidelines from many other NASA, military, and commercial human engineering standards applicable to space environments. These include: MSFC-STD-512A, Man/System Requirements for Weightless Environments; JSC-07387B, Crew Station Specifications; Boff and Lincoln's 1988 Engineering Data Compendium, addressing human perception and performance; Woodson's 1981 Human Factors Design Handbook; MIL-STD 1472, Human Engineering Design Criteria for Military Systems; and MIL-HDBK-759, Human Factors Engineering Design for Army Material. Concise design considerations, design requirements and design examples are provided.

The MSIS includes comprehensive information on anthropometry and biomechanics, human performance characteristics, and natural and induced environments, to give designers sufficient insight into the effects that these additional factors will exert on the human interfacing with the system. Using this document as a template, customized requirements specifically addressing the human factors and crew interface needs can be created.

It is appropriate to note that most of the requirements included in the MSIS were derived from terrestrial data. In this way, the human interface requirements, although developed for application to space-related systems, are also directly applicable to terrestrial systems. For example, the requirements for many of the Extravehicular Activity systems would be applicable to the development of equipment for the handling of hazardous materials or for use in hazardous environments.

Systems that could potentially benefit from the MSIS documents include automobiles, recreational vehicles, DVD players, commercial electronics hardware, home interiors, offices, and many others. By using a document such as the MSIS, the design process could be made considerably more efficient, consistent, and cost-effective.

Equipment/Software Required:
Internet access (Internet Explorer, Netscape Navigator, etc.)

Input/Output/Processing:
Internet documents

Documentation:

Man-Systems Integration Standards (MSIS), Volumes I & II.

Stage of Development:
A complete multi-media, online version of the MSIS document is available via the internet. Visitors are able to access the standards as well as reference links, search tools, and video-clips that illustrate the human factors principles applied on space missions.

Date Current Version Released:
July 1995. Rev. B

Comments:
MSIS volumes can be customized to address the concerns of specific environments such as: ocean surface, sub sea, mountainous, desert, subterranean, urban interior, etc. Systems that could potentially benefit from the custom development through the creation of additional specific volumes of MSIS documents are many and varied.

How To Acquire:
The MSIS is only distributed electronically via downloading from the MSIS website: http://msis.jsc.nasa.gov.

TOOLS

Title: 3D Static Strength Prediction Program (3DSSPP)

Overall Category: Tool
Updated: August 2004

Owner/Sponsor Organization: University of Michigan – Office of Technology Transfer
http://www.techtransfer.umich.edu

Point of Contact Information:

Mr. Doug Hockstad
734-615-4004 FAX: 734-936-1330
dhocksta@umich.edu

Product Specific Web Site:
http://www.engin.umich.edu/dept/ioe/3DSSPP/

General Overview:
This program is a software-modeling tool used to predict human static strength requirements of manual material-handling tasks such as lifts, lowers, presses, pushes and pulls. It is the result of 25 years of research at the University of Michigan's highly regarded Center for Ergonomics, and is in use at sites all over the world.

3DSSPP is used for ergonomic job analysis, design and modification for work involving materials handling. Program is used by ergonomists, engineers, loss control specialists, physical and occupational therapists, physicians, researchers and others who evaluate and design jobs, in order to help prevent worker injury, design new jobs, and evaluate changes to existing jobs.

Equipment/Software Required:
PC with Windows 95, 98, 2000, NT 4.0, or XP

Input/Output/Processing:
1. Anthropometric Data: Gender, height and weight.
2. Postural Data: Body link angles for upper arm, lower arm, torso, upper leg, and lower leg or use convenient option of prediction of posture from hand locations. Can also drag a joint location using a mouse.
3. Force Parameters: Magnitude and direction of force.

Predictions of adult population with strength to perform the task described and predictions of low back disc compression load. Comparison with NIOSH guidelines. Predictions are presented in tables and bar charts. Stick-figure illustration with balance and floor-shoe coefficient of friction values. Additional tables present joint movements, body link lengths, masses and center-of-gravity locations, abdominal pressure and force predictions, torso muscles force predictions, etc.

Documentation:
Chaffin and Andersson, "Occupational Biomechanics", John Wiley and Sons. Numerous articles in academic and professional journals.

Alternative/Comparable Approaches:
None known.

Stage of Development:
Currently available. User's manual comes with program CD.

Date Current Version Released:
Version 4.3.7 July, 2004

Validation:
Validation studies have been conducted. Please contact POC for more specific information.

How To Acquire:
University of Michigan Software
Office of Technology Transfer
3003 S. State St.
Wolverine Tower, Suite 2071
Ann Arbor, MI 48109-1280
Phone: 313-936-0435
FAX: 313-936-1330

Title: 3-D System Safety Engineering Analysis

Overall Category: Tool
Updated: October 2004

Owner/Sponsor Organization: Amencie Consultants

Point of Contact Information:

Dr. Mark M. Brauer, PE & CSP
361-387-0748 FAX: 361-387-0748
m.m.brauer@worldnet.att.net

General Overview:

Industrial Engineering and Safety textbooks follow the seminal DoD specifications and standards on this topic. This forces us to teach System Safety Engineering (SSE) with Severity and Likelihood alone, while these characteristics also do not facilitate use of normal plotting techniques. Now approved for use by the System Safety SPO, this new 3-D System Safety Engineering (SSE) Analytic Technique for the first time uses a human system analog/model/construct that integrates the human component into the equation by giving Human Exposure its due metric status, along with Severity and Likelihood, in describing System Safety, or the lack thereof, throughout our engineering texts, curricula and campuses, and in our U.S. Government specifications and standards. This model should be a key design element used during the conceptual phase of any program, and may be implemented on a Mac or PC for definition/comparison of real-world Human Factors/System Safety Engineering problems. This three-dimensional model can be demonstrated in any engineering classroom, design office or developmental laboratory. A tangible 'cubic' of the worst-case, 100-point model may be generated in any metal or wood shop.

<u>The 3-D System Safety Engineering (SSE) Analytic Technique has the following attributes</u>

1. By using a simple Arabic number (value) it improves clarity of the newly plottable Severity and Likelihood metrics, and yields a new 2-D common baseline for metrication /comparison. (Each metric may still be accessed/used independently of one another and/or the new Human Exposure metric, below.).

2. By using a simple Arabic number (value) for Human Exposure, it adds new clarity to the (new) 3-D common baseline. (Like Severity and Likelihood, above, this HE metric is an Arabic number that is also totally autonomous in its implementation, and may be accessed/used independently or in comparison with Severity or Likelihood alone.).

3. It adds a (new) 3-D worst-case 100-point model capability with which to graphically/tangibly understand this new expanded technique (five times more risk-evaluating bandwidth or resolution), and facilitates making more precise risk comparisons with other real-world systems.

4. It vastly improves the ability for visual/physical simultaneous evaluation of a specific design's resulting unique risk character in comparison with either another competing system and/or the new 100-point worst-case model (above).

5. It improves the ability to build a viable comparative risk database (historical National file).

6. It provides a functional, real-world 3-D math-modeling SSE teaching tool.

7. It satisfies the need for up-front system's risk analysis and preliminary hazards analysis -- with greater objectivity, precision, and accuracy, hence greater reliability.

8. It satisfies the need for a System Safety Engineering tool/model that can be used to standardize and thus improve the repeatability/acceptance of scores allocated to Commercial Off-the-Shelf (COTS) or developmental systems.

9. It satisfies the need to objectively select the least risky system from a group of real-world alternatives.

10. It may still be used for a paper-&-pencil SSE solution (not requiring any new/specialized equipment).

11. It is easily implemented on Mac or PC for a computerized solution or graphic solution, and can be sent out on the Net.

12, It is easily transportable geographically between workstations via Net.

Input/Output/Processing:
1. Individual severity and Likelihood metrics still autonomous/still obtained and available.

2. Once Severity and Likelihood metrics are obtained, the new process now enables immediate 2-D (planar) graphic comparison/solution.

3. Once the New Human Exposure metric is obtained using the same process that developed both Severity and Likelihood metrics above, it may be entered as a 3rd channel or vector.

4. Once all three metrics are obtained (above), this new process enables expanded, immediate 3-D (cubic) graphic or solid comparison/solution.

5. New spreadsheet matrix and/or pencil-&-paper longhand, planar approaches are still usable (this process supports and simplifies existing methodologies).

6. Simplifies computer modeling of any real-world system:
a) Any two of the three metrics (Severity, Likelihood, and now Human Exposure) of a given system may now be viewed/manipulated in 2-D with the new, simplified common-vertex planar graphical plot.
b) All three of the metrics (above) of a given system may now be:
1) Viewed/manipulated in 3-D with the new, simplified common-vertex cubic plot.
2) Physically compared with the 100-point worst-case model. (The existing truncated system vs. the 100-point worst-case cube).

7. All three system-specific metrics are available unambiguously and individually.

8. A unique, combined system-specific resultant (simple Arabic number) is always generated.

Documentation:
MIL-STD-882 and MIL-STD-1574

Alternative/Comparable Approaches:
None. This new SSE analytic technique expands upon prior art, and provides a new, common vertex that further allows the two original metrics to:

1) Be visually compared, directly, in an x-y plot,

2) Be combined with the third (new) metric, to generate a new visual x-y-z plot and/or a solid truncated cubic construct.

Stage of Development:
1) Released copyrighted/patented (pending) system.

2) Approved by the USAF System Safety Project Office for use on U.S. Government contracts and procurements after this technique's presentation at its combined session with the System Safety Society's conference in Orlando, FL in 1999.

Date Current Version Released:
18 March 2003

Validation:
Valero Manufacturing Co., 1995. ASME / NIOSH (AWARD), 1996.

Comments:
The technique is in the process of seeking formal revision to both referenced MIL-STDs: -882 and -1574. Graphic model [machine (computer)-compatible] now feasible for both solution, comparison, and storage.

How To Acquire:
Point of Contact listed above.

Title: ADVISOR 3.5

Overall Category: Tool
Updated: July 2004

Owner/Sponsor Organization: BNH Expert Software, Inc
http://www.bnhexpertsoft.com/

Point of Contact Information:

Mr. J. Bahlis
800-747-4010 FAX: 800-947-4011
bahlis@bnhexpertsoft.com

Product Specific Web Site:
http://www.bnhexpertsoft.com/

General Overview:
ADVISOR 3.5 is a decision support tool. It analyzes training courses to determine the most economical blend of delivery options including instructor-led, print, tapes, computer-based training, web-based training, electronic performance support tools, conferencing, Internet and trainers that will meet your organizational, learning and learners' needs. The results are presented in easy to follow reports and charts to effectively communicate the results to others. Key benefits include:

1. Determining the most cost-effective way to deliver training
2. Effectiveness of alternate training delivery methods
3. Computing the costs of using alternate delivery methods
4. Estimating the time required to develop various training materials
5. Return on investment (ROI) of alternate training delivery methods
6. Make decisions on method to be used to deliver training
7. Budgeting
8. Documenting training delivery method decisions

Equipment/Software Required:
IBM-compatible Pentium computer or higher; 32 MB RAM; 20 MB hard disc space; VGA or SVGA monitor.

Input/Output/Processing:
Input: data related to training course content, audience, and environment.
Output: various costs associated with trainees, instructors, development, facilities, maintenance, and hardware.

Processing: ADVISOR determines the feasibility and effectiveness of using alternate methods to deliver the training. ADVISOR computes and compares the costs of using alternate training delivery methods.

Documentation:
1. User guide
2. Tutorial
3. Context-sensitive online help
4. Searchable help

Stage of Development:
Version 3.50

Date Current Version Released:
August 2000

Validation:
Beta test on ADVISOR 3.0 was conducted by: 1) U.S. Air Force (AETC); 2) U.S. Navy (CENET); 3) U.S. Army (TRADOC); and Canadian Forces (DRET 3).

Comments:
ADVISOR 3.5 received excellent reviews from various journals and magazines, as well as end user testimonials.

How To Acquire:
Point of Contact listed above.
E-mail: info@bnhexpertsoft.com

Title: ADVISOR Enterprise

Overall Category: Tool
Updated: July 2004

Owner/Sponsor Organization: BNH Expert Software, Inc.
http://www.bnhexpertsoft.com/

Point of Contact Information:

Mr. J. Bahlis
800-747-4010 FAX: 800-947-4011
Email: bahlis@bnhexpertsoft.com

Product Specific Web Site:
http://www.bnhadvisor.com/

General Overview:
ADVISOR Enterprise is an internet based decision support tool to help organizations manage training budgets and resources from a central location as well as identify ways to run training programs more effectively and economically. ADVISOR is made up of the following 4 modules that can be used separately or in combination:

* Align training with organizational goals. A Needs Assessment/Training Needs Analysis. Conducts Mission, Job and Task Analysis as well as identify knowledge, skills and attitudes needed to achieve goals. Creates clear links between training activities, tasks and goals to help organization allocate resources to areas of greatest impact.
* Improve Human Performance. Analyzes performance deficiencies, detects the sources of the problem, identifies solutions - including training - that can produce the desired level of productivity and recommends actions to maximize the return on investment (ROI).
* Select Right Blend of Delivery Options. Analyzes the effectiveness, costs and impact of courses/training activities to determine the most economical blend of delivery options including instructor-led, print, synchronous and asynchronous eLearning options that meet organizational, learning and learners' needs.
* Effectively Manage Training Budgets and Resources. Compiles data from multiple users to determine how much money/resources are required to run various training programs, acquire required skills/competencies, find out where the money is being spent and where to allocate resources for greatest impact.

ADVISOR Key Benefits:

Uncover the cost of doing business

* Evaluate the effectiveness of present delivery options.
* Determine budget and resources required to run one or multiple training programs, gain required skills and competencies as well as find out where the money is being spent - i.e., development, delivery, travel, administrative, maintenance, support, etc.
* Estimate start-up and recurring costs of new training programs.
* Find out the true cost (including time away from the job and lost opportunity) of training sales representatives, customer service staff or developing supervisory and management skills.

Optimize training budgets and resources

* Identify opportunities to deliver training more effectively and economically. ADVISOR automatically computes and compares the costs of delivery options supported by the organization (including classroom, print, tapes, computer based training, web based training, conferencing, simulation, internet simulated classroom and electronic performance support systems) and recommends the most economical blend to meet your needs.
* Evaluate buy versus build decisions as well as conduct an unlimited number of what if scenarios to determine the most cost-effective way to design, develop, deliver, administer, manage and support various training programs.

* Minimize duplication and waste. Compare the costs of running similar training programs to quickly identify and duplicate training programs that are running efficiently as well as correct problem areas.

Improve Decision Making

* Reduce time required to prepare budgets and forecasts. Data is automatically rolled-up and compiled from managers with training/learning responsibilities; and is made available to their managers/supervisors. Detailed, up to the minute reports can be easily generated for each course, manager, division, business unit, school or the entire organization. The results are presented in a variety of formats to meet various needs.
* Defend your budget. Generate a detailed breakdown of the costs and resources required by various training programs and how they contribute to the development of skills, competencies and behaviors required by the organization to resolve specific problems, create new opportunities and increase competitive advantage.
* Align training with organizational goals. By linking courses/training activities to organizational goals (i.e., resolve specific problems, create new opportunities, increase competitive advantage, reduce employee turnover, etc.), budgets and resources required to run "need to have" versus "nice to have" training programs can be easily determined.
* Benchmark training investment. Generates ASTD equivalent benchmark reports (including training expenditure per employee and as a percentage of payroll, employee/trainer ratios, % of expenditure going to external organizations, % of training delivered using alternate technology, etc.). An effective tool for gauging your investment relative to peers and the competition, across the organization and over time.
* Develop effective presentations. Generate clear, simple to follow charts, tables and reports to effectively communicate results with others.
* Document decisions and present results with confidence. ADVISOR is based on extensive research, tested on thousands of courses and used by hundreds of organizations since 1995. Reasoning behind the recommendations and detailed computations are clearly presented and easily validated.

Equipment/Software Required:

IBM-compatible Pentium computer or higher; 32 MB RAM; SVGA monitor, 100 MB free disk space, Internet Explorer 4.0 or higher, or Netscape 4.0 or higher.

Input/Output/Processing:

Input:

1. Data related to organization/unit missions, goals, occupations, tasks, knowledge, skills, attitudes, tools, policies, training content, audience and environment.
2. Various out of pocket expenses as well as resources need to design, develop, administer, manage, deliver, support and maintain various training courses/activities.

Processing:

1. Establishes clear links between missions/goals of each unit and parent unit.
2. Establishes clear links between tasks and missions/goals.
3. Provides detailed breakdown of each task – i.e., sub-tasks, steps, etc.
4. Identifies knowledge, skills and attitudes needed to accomplish tasks
5. Identifies performance gaps as well as potential solutions
6. Computes and compares the costs of alternate solutions
7. Determines the feasibility and effectiveness of using alternate methods to deliver the training.
8. Computes and compares the costs of various blends of delivery options

Output:

1. Mission Analysis
2. Job/Occupation Analysis
3. Task Analysis
4. Performance Analysis
5. Media Analysis
6. Cost Analysis
7. Return on Investment (ROI) Analysis

Documentation:
1. User guide
2. Tutorial
3. Context-sensitive online help

Stage of Development:
Version 5.4

Date Current Version Released:
Version5.4 was released February 2004.

Validation:
Beta test on ADVISOR 4.0 was conducted by: 1) U.S. Air Force (AETC); 2) U.S. Navy (CENET); 3) U.S. Army (TRADOC); and Canadian Forces (DRET 3).

Comments:
ADVISOR 4.0 received excellent reviews from various journals and magazines, as well as end user testimonials.

How To Acquire:
Point of Contact listed above.
E-mail: info@bnhexpertsoft.com.

Title: Applied Cognitive Task Analysis (ACTA)

Overall Category: Tool
Update: February 2005

Owner/Sponsor Organization: Klein Associates, Inc.
http://www.decisionmaking.com/

Point of Contact Information:

Mr. Buzz Reed
937-873-8166 FAX: 937-873-8258
info@decisionmaking.com

General Overview:
ACTA is an instructional software tool that is designed to assist practitioners in identifying cognitive skills, or mental demands, that are needed to perform a task. These skills/demands include: critical cues and patterns of cues; assessment, problem solving, and decision-making strategies; why these are difficult for novices; and common novice errors. ACTA provides a means for practitioners to elicit this kind of information and incorporate it into instructional design interventions.

ACTA is a support tool for cognitive engineering and decision-centered design approaches to systems, user interfaces, and training interventions

Equipment/Software Required:
Minimum: 486 DX2-66 MHz, PCI or SCSI-2 device bus;16-bit Soundblaster-compatible speakers; video card with 2MB RAM, 64-bit data path; quad-speed CD-ROM; Windows 95, or Windows 3.1; standard screen size of 640 x 480,resolution setting for "thousands of colors".

Input/Output Processing:
This is an instructional tool. Users of the software will learn to conduct applied cognitive task analyses.

Documentation:
Militello, L.G., Hutton, R.J.B., Pliske, R.M., Knight, B.J., & Klein, G. (1997), "Applied Cognitive Task Analysis (ACTA) Methodology", Fairborn, OH: Klein Associates, Inc. Final Technical Report prepared for the Navy Personnel Research and Development Center under Contract No. N66001-94-C-7034.

Stage of Development:
Version 1.0.

Validation:
(See Documentation, above.)

How To Acquire:
Point of Contact listed above.

Title: Army Military-Civilian Cost System (AMCOS)

Overall Category: Tool
Update: November 2002

Owner/Sponsor Organization: Deputy Assistant Secretary of the Army (Cost & Economics)
http://www.ceac.army.mil/

Point of Contact Information:
Mr. Joseph Gamble
703-614-5876 DSN: 224-5876 FAX: 703-695-5717
amcos@hqda.army.mil

Product Specific Web Site:
Demo - http://www.ceac.army.mil/amcos/amcosweb/demo/frame.htm

General Overview:
The Army Military-Civilian Cost System (AMCOS) is a database of active, reserve, and civilian manpower data developed for accuracy and flexibility of manpower cost estimation. It provides military and civilian cost estimates for acquisition, installation operations, force/unit costing, and a variety of cost analysis requirements. AMCOS is used to forecast the life cycle of a new or proposed weapon system by year, for each Military Occupational Specialty (MOS), as well as for the entire system. The models incorporate data from a variety of sources and compute cost elements, such as military compensation, recruiting, training, and medical support for each MOS. These cost elements are then incorporated into a life-cycle cost-estimating routine. The model generates the manpower costs for the life cycle of the system.

The output is used to develop the most cost-efficient system and develop the cost-effective manpower and hardware configuration for the system. In addition, the output is used to choose the most efficient manpower mix and cost changes in personnel policies, and to estimate budget costs of personnel policies.

Equipment/Software Required:
IBM-compatible PC.

Input/Output/Processing:
The input for this method consists of manpower by grade by MOS.

The processing of the information specifies manpower requirements by pay grade for each MOS for up to a 30-year life cycle. MOS-specific and total costs are generated.

The output is manpower costs by MOS by year and budget appropriation category.

Documentation:
"Army Manpower Cost System (AMCOS)," ARI Research Focus, US Army Research Institute for the Behavioral and Social Sciences, June 1987.

Stage of Development:
Version 04. Officer, enlisted, and civilian component life-cycle cost models are currently available.

Date Current Version Released:
October 2001

Comments:
AMCOS will soon be on the internet.

How To Acquire:
Mr. Joseph Gamble, Programs & Strategy
ATTN: SAFM-CES
109 Army Pentagon, Room 3D349
Washington, DC 20310
(703) 614-5876.

Title: Articulated Total Body (ATB) Model

Overall Category: Tool
Updated: December 2004

Owner/Sponsor Organization: Air Force Research Laboratory
http://www.afrl.af.mil/

Point of Contact Information:

Dr. Joseph Pellettiere
937-255-1150 DSN: 785-1150
joseph.pellettiere@wpafb.af.mil

General Overview:

The Articulated Total Body (ATB) model is a computer simulation program developed by the Armstrong Laboratory (AL) for the prediction of human body dynamics during aircraft ejection, aircraft crashes, automobile accidents, and other hazardous events. It is a three-dimensional, coupled, rigid-body dynamics model, in which each body link is defined as a rigid segment.

Because of its capability for predicting the motion and forces on the human body, manikins, seats, and other structures, the ATB model has broad applications in the automobile, aerospace and other transportation systems communities. It is used in the Air Force to determine the safety of restraint systems, seats, escape systems, controls and displays, and other equipment in the aircraft cockpit before prototypes are built or costly tests conducted. It is also used to provide data that cannot be measured during a test, such as forces within the body, and to supplement test data with parameter variation simulations.

Equipment/Software Required:

The ATB model is written in FORTRAN77. It runs on most computers having a FORTRAN compiler, including personal computers, workstations, and main frames. Because of the program's size, Pentium I or higher personal computers are recommended.

Input/Output/Processing:

The input requirements for an ATB simulation include a description of the human or dummy body, the environment, the driving motion or force, and the initial conditions. The body data can be obtained using the Generator of Body (GEBOD) (q.v., this Directory) preprocessing program which calculates the required data for adult males, adult females, children, or test dummies.

The model uses the three-dimensional forms of Newton's Second Law and Euler's Equation as the equations of motion for each body segment, and Lagrange-type equations to apply the joint constraints. Constitutive equations are used to model body interactions with restraint belts, air bags, wind, and surrounding surfaces represented by planes and ellipsoids.

The program has many output options, including data required for depicting the body motion, tabular data on the simulation status as specified time intervals, and time histories. A wide range of time histories can be generated for each simulation, including segment linear and angular positions, velocities, and accelerations; joint angles, and torques; body center of mass location, momentum, and kinetic energy; and contact, belt, and aerodynamic forces.

Recent updates have been made to the program to include dynamic memory allocation, Fortran 90 variable constructs, the elimination of common block variables and the ability to use list directed input with comments in the input stream.

Documentation:

Cheng, H., Rizer, L., and Obergefell, L., "Articulated Total Body Model Version V User's Manual," Air Force Research Laboratory Report No. AFRL-HE-WP-TR-1998-0015, Wright-Patterson AFB, OH, February, 1998.

Obergefell, L., Gardner, T., Kaleps, I., and Fleck, J., "Articulated Total Body Model Enhancements, Volume 2: User's Guide," Armstrong Laboratory Report No. AAMRL-TR-88-043, Wright-Patterson Air Force Base, OH, January 1988.

Alternative/Comparable Approaches:
The ATB model is also available in a complete software package, named ATB3I (q.v., this Directory), which includes a user-friendly preprocessor for developing the database needed for a simulation, the ATB model, and a post-processor for plotting the body motion. ATB3I is a Windows-based program which uses OpenGL for graphics, and has options for directly creating videos. Dynamic models with features similar to the ATB include MADYMO, developed by TNO in the Netherlands, and MVMA3D, by the Motor Vehicle Manufacturers Association. Additionally, ATB has been successfully coupled with the finite element packages LS-DYNA and MSC/DYTRAN.

Stage of Development:
Complete and operable with revisions released periodically.

Date Current Version Released:
Current Version 5.3 Released September 2004.

Validation:
Numerous validation studies have been conducted for particular applications of the ATB model. Some validation efforts are documented in:

Fleck, J.T., Butler, F.E., and DeLeys, N.J., "Validation of the Crash Victim Simulator," Calspan Report No. ZS-5881-V-2, DOT-HS-806-290, Vol. 2 (NTIS No. PC E99, PB 86-212420), 1982.

Obergefell, L.A., Kaleps, I., and Steele, S., "Part 572 and Hybrid III Dummy Comparison Sled Test Simulations," SAE Paper No. 880639, Detroit, MI, February 1988.

Kaleps, I., "Prediction of Whole-Body Response to Impact Forces in Flight Environments," AGARD Conference Proceedings No. 253, Paris, France, 6-10 November 1978.

Smith, J. A., Rizer, A.L., and Obergefell, L.A., "Predictive Simulation of Restrained Occupant Dynamics in Vehicle Rollovers," SAE Paper No. 930887, Detroit, MI, 1-5 March 1993.

Comments:
The ATB program was originally developed as the Crash Victim Simulator (CVS), and has been known as Cal3D.

How To Acquire:
Point of contact listed above.

Title: ASC Logistics Composite Model (LCOM)

Overall Category: Tool
Update: July 2004

Owner/Sponsor Organization: Aeronautical Systems Center
http://ascpa.public.wpafb.af.mil/

Point of Contact Information:

Mr. Frank Erdman
937-255-8060 DSN: 785-8060
francis.erdman@wpafb.af.mil

General Overview:

ASC LCOM is a Monte Carlo simulation model, written in SIMSCRIPT II.5 and is used to model the interaction of maintenance, operations, and supply functions for any type of system (mechanical, electronic or weapon system).

The model can and has been used to develop and analyze a baseline comparison system as described in MIL-STD-1388-1A, Task 203. The model can and has been used to perform trade-offs and evaluations as described in MIL-STD-1388-1A, Task 303. The model can and has been used to evaluate the interaction of any of the following Integrated Logistics Support elements: 1) Maintenance Planning; 2) Facilities; 3) Design Interface; 4) Support Equipment; 5) Manpower & Personnel; 6) Supply Support; and 7) Packaging, Handling, Storage and Transportation (PHS&T).

Output from ASC LCOM can be used to develop and analyze a baseline comparison system, or perform trade-offs and evaluations of the various Integrated Logistics Support elements.

Equipment/Software Required:

ASC LCOM is available for MS Windows and for Sun Solaris.

Input/Output/Processing:

Since LCOM has been in use for over twenty years, much work has been done on input data sources. The following is a description and current status of those data sources:
1) USAF Maintenance Data (DO56 or CAMS/REMIS) - Automated data extractions and conversion programs are in use.
2) NAVY 3M Data - Data extraction queries have been developed for use with the Naval Aviation Logistics Data Analysis (NALDA) system. The process of manual conversion of the data to LCOM input format is being automated.
3) MIL-STD-1388-2A Logistics Support Analysis Record (LSAR) - An automated data extraction and conversion program from the LSA Control Number Master File to LCOM format is in use.
4) MIL-STD-1388-2B LSAR (Relational DBMS) - The data elements requiring extraction have been identified. One contractor already has an in-house extraction and conversion program.
5) National Stock Numbers (NSN) - Manual data extraction is in use. No conversion is needed since the entire NSN can be input into the 18-character LCOM task name.
6) MIL-STD-1808, Notice 1, System/Subsystem/Subject Number (S/S/SN). One contractor already has an in-house conversion program to LCOM.

The LCOM analyst can utilize over 140 built-in statistics, schedule specialized reports at any time or frequency during the simulation, or execute post-processor programs for detailed analysis of events that occurred during the simulation. The 140 built-in statistics are grouped together into eight major categories:
1) Operations
2) Non-flying Activities

3) Aircraft
4) Personnel
5) Shop Repair
6) Supply
7) Support Equipment
8) Facilities

The specialized reports allow "snapshot" looks at what is happening during the simulation. The five post-processor programs: 1) provide a graphical aircraft timeline display; 2) provide mission success statistics; 3) provide a graphical manpower utilization matrix display; 4) provide graphical support equipment & facilities; and 5) provide desired spares quantities based on peacetime and economic ordering rules.

Documentation:
A user's manual is available as an Adobe Acrobat (.pdf) document.

Stage of Development:
The LCOM model was developed as a joint project between the Air Force and Rand Corporation in the late 1960's. It has been available for use since the early 1970's. New features/updates have been constantly added and the latest update is scheduled for 4th quarter 2004. Support tools are also available, including an application to assist in data development. This tool is called ASC LCOM Graphical Network Editor (GNE), and it provides a graphical environment for data editing and a convenient display view of task network layouts. The ASC LCOM Output Tool displays simulation results in customizable MS Excel charts.

Date Current Version Released:
Current Version: ASC LCOM 2.6.3, released 2nd quarter 2004.
Next Version: ASC LCOM 2.7 planned for 4th quarter 2004.

Validation:
HQ Tactical Air Command (now Air Combat Command), "LCOM F-4E Field Test Final Report 15 Jan - 9 Mar 1973."

How To Acquire:
Contact Frank Erdman at 937-255-8060 or francis.erdman@wpafb.af.mil. Distribution is available via CD-ROM, FTP download, or tape (if necessary).

Title: ATB3^{I}

Overall Category: Tool
Updated: January 2005

Owner/Sponsor Organization: General Dynamics Advanced Information Systems
http://www.gd-ais.com/

Point of Contact Information:

Dr. Joseph Pellettiere
Air Force Research Laboratory
937-255-1150 DSN: 785-1150
joseph.pellettiere@wpafb.af.mil

Product Specific Web Site:
http://www.atb3i.com/

General Overview:
ATB3^{I} is a complete software simulation package for the prediction of human body dynamics during aircraft ejection, aircraft crashes, automobile accidents, and other hazardous events. It includes a Microsoft Access Database, a user-friendly pre-processor for building the database needed for a simulation, the Articulated Total Body (ATB) (q.v., this Directory) simulation program, and a post-processor for plotting the simulated body motion and creating videos.

Because of its capability for predicting the motion and forces on the human body, manikins, seats, and other structures, the ATB3^{I} model has broad applications in the automobile, aerospace, and other transportation systems communities. It is used in the Air Force to determine the safety of restraint systems, seats, escape systems, controls and displays, and other equipment in the aircraft cockpit before prototypes are built or costly tests conducted. It is also used to provide data that cannot be measured during a test, such as forces within the body, and to supplement test data with parameter variation simulations.

The simulation results can be used to determine equipment clearances, to estimate injury, and to investigate body motion and safety. Post-processor output also can be captured for importation into spreadsheet, word processor, or graphics programs.

Equipment/Software Required:
ATB3^{I} runs on Windows 2000/XP personal computers.

Input/Output/Processing:
The pre-processor input requirements for a simulation include a description of the human or dummy body, the environment, the driving motion or force, and the initial conditions. These input data are saved in the database. The body data can be obtained using a pre-processing module based on Generator of Body Data (GEBOD) (q.v., this Directory), which calculates the required data for adult males, adult females, children, or testing dummies. GEBOD is integrated with ATB3^{I} and its accompanying data set of dummies and joint functions are stored in the database.

The input is processing by the simulation model. This ATB simulation model uses the three-dimensional forms of Newton's Second Law and Euler's Equation as the equations of motion for each body segment, and Lagrange-type equations to apply the joint constraints. Constitutive equations are used to model body interactions with restraint belts, air bags, gravity, wind, and surrounding surfaces represented by planes and ellipsoids.

The post-processor provides plots and tables of a wide range of time histories, including segment linear and angular positions, velocities, and accelerations; joint angles, forces, and torques; body center of mass location,

momentum, and kinetic energy; and contact, belt, and aerodynamic forces. It also depicts the body and its environment at any time step with shaded solid ellipsoids, allowing the user to interactively adjust viewing angles and drawing options. The output also can be saved to a picture file or as a video.

Documentation:
Cheng, H., "Development of Professional Software - ATB3I," Masters Thesis, Wright State University, Dayton, OH, March, 1999.

"ATB3^{I} Training Tutorial," General Dynamics Advanced Information Systems, Dayton, OH, 2002

Alternative/Comparable Approaches:
The ATB3^{I} model is available separately, and can be run on a wider variety of computers. Dynamic models with features similar to ATB3^{I} include MADYMO, developed by TNO in the Netherlands, and MVMA3D, by the Motor Vehicle Manufacturers Association.

Stage of Development:
Developed by General Dynamics Advanced Information Systems, ATB3^{I} has been commercially released with incremental updates.

Date Current Version Released:
Version 2.0 released 1/2005

How To Acquire:
General Dynamics Advanced Information Systems
5200 Springfield Pike, Ste. 200
Dayton, OH 45431-1289
(937) 255-9339
Email: Huaining.cheng@wpafb.af.mil

Title: Auditory Hazard Assessment Algorithm (AHAAH)

Overall Category: Tool
Update: August 2004

Owner/Sponsor Organization: Army Research Laboratory (ARL/HRED)
http://www.arl.army.mil/ARL-Directorates/HRED/hred.html

Point of Contact Information:

Dr. Joel Kalb
410-278-5977 DSN**:** 298-5977 FAX: 410-278-3587
jkalb@arl.mil

Product Specific Web Site:
http://www.arl.army.mil/ARL-Directorates/HRED/AHAAH/

General Overview:
Modern weapons produce intense acoustic impulses that pose a serious risk of hearing loss, which limits both their design and use. The civilian world also contains many noise sources that fall in the same category, e.g. automotive airbags, construction tools, sport shooting. Current noise exposure standards for impulse noise are not theoretically based, and it is generally agreed that they are seriously in error, especially for impulses with significant low-frequency energy. To meet the need to deal with hazard from sounds with peak SPLs above 130 db, HRED developed a mathematical model of the human ear that predicts the hazard from any free-field pressure, and provides a visual display of the damage process as it is occurring in the inner ear. The model is a powerful design tool because it not only provides a numerical rating of hazard, but also identifies specific parts of the waveform that are causing the hazard. This unique model can assess noise hazard from any intense sound, and has the potential both to serve as an international design standard and as a damage risk criterion for intense sounds.

Used for hazard assessment (damage risk criterion); design criterion; analysis of sources of hazard and their amelioration.

Equipment/Software Required:
Personal computer and AHAAH software

Input/Output/Processing:
Uses digitized acoustic waveform input, the AHAAH software to produce numeric hazard values, and a movie of the development of hazard.

Documentation:
Read-me files included with this software.

Alternative/Comparable Approaches:
Nothing comparable.

Stage of Development:
Algorithms functional; model has been validated and peer reviewed.

Date Current Version Released:
Version 3.0, 17 Nov 2003

Validation:
Validation and peer review available on:

http://www.arl.army.mil/ARL-Directorates/HRED/AHAAH

Comments:
AHAAH model accepted in Society of Automotive Engineers Standard J2531: Impulse noise from automotive inflatable devices (2003)

Model currently being recommended by US Army Center for Health Promotion and Preventive Medicine (USACHPPM) as basis for hazard assessment for all unprotected exposures above 140 dB Peak.

How To Acquire:
Model, documentation, and validation data available for download on:
http://www.arl.army.mil/ARL-Directorates/HRED/AHAAH

Title: Authoring Instructional Materials (AIM)

Overall Category: Tool
Update: August 2003

Owner/Sponsor Organization: NAVAIR Orlando - Training Systems Division
http://www.ntsc.navy.mil/

Point of Contact Information:

Mr. Alan Litz
407-381-8607 DSN: 960-8607 FAX: 960-4519
alan.litz@navy.mil

Product Specific Web Site:
http://ete.fedsun.navy.mil/

General Overview:
Authoring Instructional Materials (AIM) is a government-managed system used by the Navy and other agencies to develop, update, manage, and integrate training content. It automates the systems approach to training and ensures uniform formatting and compliance of all required output products, in any form, from paper to web. AIM provides for highly efficient design, development, surveillance, maintenance, and production of training/educational materials. The AIM application is used to support:

* Content Design
* Links learning requirements to performance standards
* Content Development
* The creation and/or association of existing training content to support a specific objective
* Link training content to Interactive Electronic Tech Manuals (IETMs)
* Content Surveillance and Maintenance
* Automated notification by flagging of potential content change requirements based on performance standard changes or tech data changes and generation of detailed training content change packages. Promotes integration of changes into previous baseline curricula with minimum impact.
* Content Production
* Standard output of training content products in paper, PDF, HTML, and XML formats
* Content Management
* Privilege levels in AIM ensure that only those personnel who are authorized to perform certain functions in curriculum management, delivery, and update have access to the tools and baseline data to do so

AIM provides tight integration with the Automated Electronic Classrooms by providing direct database connectivity, XML, or HTML output to support delivery of training in local or wide-area. AIMs XML output is delivered as a SCORM 1.2 package. AIM users can also create and maintain links to interactive Electronic Technical Manuals (IETMs) and integrate rich media.

AIM provides:
* Complete course materials for instructor and student in both traditional and electronic classrooms.
* Surveillance reports to streamline life-cycle maintenance of curricula and drastically reduce both manpower and time required to keep curricula complete and accurate.
* Upcoming releases of AIM will include the capability to link validated training requirements to existing content in AIM and support the developer in repurposing traditional instructor-led content to Reusable Learning Objects in accordance with the Navy's emerging model to support the Integrated Learning Environment (ILE) initiative.

Equipment/Software Required:

Minimum Requirements:
CPU with a 400 MHz Pentium II processor or better. The CPU must have at least 128 mb of RAM. 2 GB or hard drive space is recommended for the software including a populated database, graphics and media. Windows 98 or Higher or Windows NT.

Recommended required:
CPU with a 1 GHz Pentium 4 processor or better. The CPU should have at least 256 mb or RAM. 20GB or more of hard drive space is recommended for the software including a populated database, graphics and media files. Windows 2000 or Windows XP.

Input/Output/Processing:
AIM is an integrated collection of commercial software products tied together through government software. For example, AIM uses a Microsoft Access or SQL Server database engine to store training content chunks and establish links between them. Links are established to ensure that content is tied directly to a learning or performance support objective. These objectives, in turn, are tied directly to a selected task.

Instructional developers and Subject Matter Experts (SMEs) input required tasks, refine Learning Objectives (LOs) from system-generated prototype LOs, structure course materials, and input detailed discussion and student activity information for integration and maintenance in the relational database. AIM is also capable of extracting IETM structural information and creating automated links from instructor and student materials to pertinent sections of the operational IETM.

Documentation:
Software User's Manual, April 2003.

Alternative/Comparable Approaches:
AIM is designed to replace word-processing based curriculum authoring and maintenance systems that require expertise in generation and formatting of complex documents by instructional designers and/or SMEs. The database foundation of AIM also provides many enter-once, use many times features to streamline both development and maintenance, as well as providing far superior configuration management capabilities.

Stage of Development:
Currently supported and used within the U.S. Navy, and other non-Navy users.

Date Current Version Released:
2004

Validation:
Approximately 300,000 hours of formal training supported by AIM.

Comments:
AIM is a mature application known for its adaptability to ever changing requirements. The AIM System Support Office (SSO) also provides responsive and expert functional and technical assistance by phone, on-line, and on-site.

How To Acquire:
Point of Contact listed above.

Title: Automated Neuropsychological Assessment Metrics (ANAM)

Overall Category: Tool
Update: July 2004

Owner/Sponsor Organization: Naval Computer and Telecommunications Station (NAVCOMTELSTA)

Point of Contact Information:

Ms. Kathy Winter
Space and Naval Warfare Systems Command (SPAWAR)
850-452-7644 DSN: 922-7644
kathy.winter@navy.mil

General Overview:
The Automated Neuropsychological Assessment Metrics (ANAM) is designed with emphasis on both clinical and experimental applications which require repeated measures testing. A large pool of test items together with psuedo randomization techniques give each test a large number of multiple forms. This permits ANAM tests to be used during extended baseline testing and for monitoring performance over extended periods of time. ANAM tests are self-contained testing modules, easily re-configured and "fine-tuned" to compensate for individual differences and changes in environmental demands. Subject instructions are independent ASCII files for adaptation to multi-national or multi-cultural administration.

ANAM can be used in both research and clinical applications. Military research applications include monitoring cognitive status in exotic environments (i.e., 30-day undersea missions and Spacelab missions), and measuring effects of fatigue during Desert Storm B-1 bomber missions and of being wounded with depleted uranium bullets during Desert Storm. Clinical applications include quantifying inconstancy effects, tracking recovery of function, and assessing efficacy of therapeutic intervention on head injury patients. The repeated measures function allows for testing for differential effects of pharmaceutical treatment drugs.

The summary dataset is formatted so that it can be easily exported to statistical packages, i.e., SAS, SPSS. The text report dataset allows a quick visual analysis of the individual test's data. One utility program is provided with the ANAM. This program allows summary files to be concatenated and viewed, providing a quick visual scan of the results of several tests simultaneously.

Equipment/Software Required:
The equipment required to run ANAM consists of an IBM-compatible PC, with Windows NT 4.0, Windows 98 SE, Windows 2000 or Windows XP.

Input/Output/Processing:
The ANAM menu, which will run a multi-test battery, prompts for subject ID, for dominant hand, for instructions on/off, for instruction file extension (for multi-language), for selection of tests, full battery or restart, and for the location to store the subject's data, i.e., drive and subdirectory.

Subject's data is stored to the chosen disk and subdirectory. Traditional measures of response times, number correct/incorrect, means, medians, and standard deviations of correct/incorrect and response times are collected. Other measures, such as throughput, response lapse and bad response information, are also stored.

Three types of output files may be written and stored to disk. The summary dataset contains processed data, as listed in Processing Techniques. A report or text dataset is created and presents the summary statistics in a report format with titles and column headers. A raw dataset is created, which contains the stimulus presented, correct answer, subject's and response time. The summary and raw data are also available in XML format. All data files can be encrypted.

Documentation:

Reeves, D.L., Winter, K., LaCour, S., Raynsford, K., Kay, G., Elsmore, T., and Hegge, F.W., "Automated Neuropsychological Assessment Metrics Documentation: Vol. I Test Administration Guide", Office of Military Performance Assessment Technology: Walter Reed Army Institute of Research, Washington, D.C., 1992.

Stage of Development:
Fully mature.

Validation:
ANAM has been validated. For specific validation information, contact the POC.

How To Acquire:
The use of ANAM requires a Software Users Agreement. Contact tara.mose@det.amedd.army.mil for details.

Title: Boeing McDonnell Douglas Human Modeling System (BMD-HMS)

Overall Category: Tool
Update: July 2004

Owner/Sponsor Organization: The Boeing Company

Point of Contact Information:
Mr. Steve M. Rice
562-593-1492 FAX: 562-982-9456
steve.m.rice@boeing.com

Product Specific Web Site:
http://www.boeing.com/assocproducts/hms/

General Overview:
The Boeing Human Modeling System (BHMS) is a software tool designed specifically for engineering applications. BHMS is a menu-driven, interactive computer program used to define human factors design requirements and aid in design evaluation. BHMS provides a powerful set of human modeling and human task simulation tools that allow the user to establish design-to requirements, test reach accommodation, study human motion, and perform various fit and function evaluations of their present design.

The primary purposes of the BHMS are to assist in formulating human factors design requirements, and to aid evaluations of human interaction with work site designs. The major benefits of using human modeling in electronic design include: (1) reducing the need for physical development fixtures by performing evaluations electronically; (2) reducing design costs by enabling the design team to more rapidly prototype and test a design; (3) avoiding costly design 'fixes' later in the program by considering human factors requirements early in design; and (4) improving customer communications at every step of product development by using compelling animated graphics.

BHMS has been used in many engineering applications, and has demonstrated its value and versatility as a design tool.

Analyst qualifications: Training required - minimum of working through online tutorials; some knowledge of CAD and Human Factors helpful.

Equipment/Software Required:
IBM Risc 6000 (AIX)
Hewlett Packard (HP/UX)
Silicon Graphics (IRIX)
NT, Windows 2000 or later.

3D Data Input Formats:
VRML 2.0
IGES (Initial Graphics Exchange Specification)
STL (Stereo Lithography)
FlyThru (Boeing Proprietary Format)

Software is downloadable from the distribution web site.

Documentation:
Available online: Reference Manual, Installation Guide, Applications/Tutorial Guide, Validation Manual, as well as case studies.

Stage of Development:
Version 3.6

How To Acquire:
Refer to the web site listed above.

Title: Command, Control, and Communication-Techniques for Reliable Assessment of Concept Execution (C3TRACE)

Overall Category: Tool
Update: August 2004

Owner/Sponsor Organization: US Army Research Laboratory, Human Research and Engineering Directorate
https://arlinside.arl.army.mil/hred/

Point of Contact Information:

Ms. Patricia W. Kilduff/Engineering Psychologist
410-278-5874 DSN: 298-5874 FAX: 410-278-9694
pkilduff@arl.army.mil

General Overview:
C3TRACE provides an environment that can be easily used to evaluate the effects of different personnel configurations and information technology on human performance as well as on overall system performance. This tool provides the capability to represent any organization, the people assigned to that organization, the tasks and functions they will perform, and a communications pattern within and outside the organization, all as a function of information flow and information quality.

Current research efforts involving C3TRACE include evaluation of Future Combat System (FCS) staff structure concepts at different echelons. Recently, the tool was used to develop a model of the Unit of Action Mounted Combat System (MCS) Company Headquarters. It is also being used to develop models of the MCS Platoon Leader Vehicle (PLV) and the Infantry Carrier Vehicle (ICV) and the dismounts in order to characterize operator workload and the incoming messages during each mission segment. Both of these research efforts are using C3TRACE to track the resulting information quality that is being used to make a decision as it is processed by the proposed staff structure and the probability of making a good decision based on that information.

Some of the factors that can affect information quality and cause uncertainty include unreliable or incomplete sensor data, embedded fusion algorithms, communications and network status, display design quality, and mismatch of multiple sources of information just to name a few.

Equipment/Software Required:
C3TRACE is designed to execute in a Microsoft Windows 2000, ME or XP environment. Note: C3TRACE will NOT work on Windows NT, 95 or 98 operating systems. Computer system requirements include a VGA monitor, a Pentium processor, and approximately 100 MB of hard disk space. Additionally, the program requires a minimum of 128 MB of RAM to run efficiently. If you machine has more RAM, the C3TRACE tool will perform faster data saves, exhibit improved navigation speed, and execute the model faster.

Input/Output Processing: Input/Output/Processing:
Input:
1) Define the Organization – define what sections and operators are to be included in the analysis, input operator characteristics (optional).

2) Define the Functions and Tasks – decompose functions into a network of tasks to include sequencing, decisions, and queues. Each task can also be defined according to how it enhances situational awareness (SA). The modeler can choose from three levels of SA or none: 'Perception of elements in current situation,' 'comprehension of current situation,' or 'projection of future status.'

3) Define the Communication Events – input all message traffic (including face-to-face, digital, voice, and written), assign information elements to each message. These elements are used to define what information is

contained in each message. As a message flows through the task network, the simulation will track when the operators were last exposed to each element.

Processing: All messages are processed either by the lead, assisting, or supporting operator. The initiation of the task network is the result of receipt of a particular message. Information elements that are tied to each message are kept track of in terms of time during the model run. The model keeps track of when each operator was last exposed to each element of information. This information quality is then used in an embedded decision algorithm to determine the probability that an operator has the right information to make a "good" decision.

Output: In the form of several reports to include: Operator Utilization, Interrupted and Dropped Tasks, Dropped Messages, Decision Quality, Workload, Situational Awareness, Sensor to Shooter Report, and a Message Processing Times report.

Documentation:
"Software User's Manual for: C3TRACE (Command, Control, and Communication-Techniques for Reliable Assessment of Concept Execution)," Jul 23, 2002, Beth Plott, Micro Analysis and Design, Inc., Boulder, CO. The C3TRACE application contains an embedded help feature and the CD that contains the application also contains an electronic copy of the software user's manual.

Alternative/Comparable Approaches:
The underlying technology in C3TRACE is discrete task network modeling. IMPRINT, IPME, and WinCrew all use the same Micro Saint simulation engine as C3TRACE, but have different goals, inputs, and outputs. The Timeline Management Tool (TMT) is also used to perform crew system analysis using a task timeline approach.

Stage of Development:
The current version is 2.0, dated Dec 2003. Version 2 is built on top of the Micro Saint Sharp simulation engine and provides C3TRACE with the capability for an easy migration path for the latest technology additions; an industry standard interface; modularity to include a plug-in interface and object oriented model development; and easier integration not only with external software applications but with its own individual tools.

Future tool enhancements include parameters specific to multinational models. In addition, work is in progress to develop algorithms that will measure the effect of specific instances of uncertainty and SA level on decision-making. The data for the self–efficacy (confidence in one's ability to do well) and job experience algorithm has been analyzed and is currently being formatted for input into C3TRACE.

Date Current Version Released:
December 2003

Validation:
Validation studies are planned for the near future when tool development is completed.

Comments:
C3TRACE is the result of a need expressed by the Fort Sill Battle Lab for a powerful modeling environment without the need for expert programmers. Future plans include possible linkage to other modeling and simulation tools such as OneSAF (One Semi-Automated Forces) Testbed, MATREX (Modeling Architecture for Technology, Research, and Experimentation), and ACT-R (Atomic Components of Thought-Rational).

How To Acquire:
To receive a free copy of C3TRACE or if you have questions, contact Jennifer C. Swoboda, Comm. (410) 278-5948, DSN 298-5948, jcrouch@arl.army.mil or Patricia W. Kilduff, Comm. (410) 278-5874, DSN 298-5874, pkilduff@arl.army.mil.The requesting individual must sign a non-disclosure agreement before receiving the software. Training workshops are conducted as needed. Distribution of this tool to foreign governments is to be negotiated on a case-by-case basis.

Title: Complex Cognitive Assessment Battery (CCAB)

Overall Category: Tool
Update: July 2004

Owner/Sponsor Organization: Naval Computer and Telecommunications Station (NAVCOMTELSTA)

Point of Contact Information:
Ms. Kathy Winter
Space and Naval Warfare Systems Command (SPAWAR)
850-452-7674 DSN: 922-7674
kathy.winter@navy.mil

General Overview:
CCAB contains nine tests of higher cognitive functions. The tests are: Tower Puzzle, Mark Numbers, Numbers and Words, Information Purchase, Route Planning, and Missing Items. The PC-based software features the capability of customized test configurations, menu-driven software, repeated measures, variable levels of difficulty, and automated scoring and reporting. CCAB is written in the C programming language.

The appropriate uses of CCAB vary with the user. For the military, CCAB can test the effects of battlefield stressors on cognitive performance. It also can test for differences in Military Occupational Specialty (MOS) requirements. For the academic, the repeated measures feature makes the CCAB ideal for drug or sleep-deprivation research. The CCAB also can be used for the basic investigation of higher cognitive functioning. For users in industry, CCAB's flexibility permits configuration of specialized batteries for jobs with different cognitive profiles. CCAB can be used in the health field as an aid for neuropsychological testing of higher cognitive functions.

The format of the CCAB screen or paper printouts allows a quick observational analysis of the output as a function of test variables. The data also are readily available for transfer to common statistical packages for formal data analysis.

Equipment/Software Required:
The equipment required to use CCAB consists of an IBM compatible PC.

Input/Output/Processing:
The inputs required to use CCAB include study design parameters the user provides via the CCAB setup feature. That feature prompts for subject code, which tests will be run, in what order, number of trials per test, number of seconds per trial, and whether instructions, a quiz, practice trials or feedback to the participant is wanted. The participants respond to stimulus events from CCAB on the monitor and respond appropriately by pressing predefined keys on the standard PC keyboard.

The processing of the input consists of the participant's responses being automatically saved to the hard drive. Traditional measures of response times and number correct and incorrect are provided by CCAB. Internal algorithms calculate synthesized measures of performance.

The output from CCAB consists of test results which may be viewed on the monitor or printed on paper. Results are available immediately upon completion of individual tests. Measures within tests are organized by trial. A between-test integrated summary combines key performance items across all the tests.

Documentation:
"Expanded Complex Cognitive Assessment Battery (CCAB): Final Test Administrator User Guide," US Army Research Institute, December 87.

"Expanded Complex Cognitive Assessment Battery (CCAB): Test Descriptions," U.S. Army Research Institute, March 88.

Alternative/Comparable Approaches:
None known.

Stage of Development:
Fully mature.

Validation:
CCAB has been validated. Validation information pertaining to certain groups may be available. Call the POC for more specific information.

Comments:
The nine CCAB tests are based on the psychological literature. A full description of the background of each test is provided in the "Expanded Complex Cognitive Assessment Battery (CCAB): Test Descriptions" manual cited above.

How To Acquire:
To obtain, write: NAVCOMTELSTA, Code N52 (Ms. Kathy Winter), 130 West Ave., Ste. B, Pensacola, FL
email: kathy.winter@navy.mil

Title: ComputerMan

Overall Category: Tool
Update: April 2003

Owner/Sponsor Organization: Army Research Laboratory
http://www.arl.army.mil/slad/

Point of Contact Information:

Mr. Ed Davis
410-278-6309 DSN: 298-6309
edavis@arl.army.mil

General Overview:

The ComputerMan Model is a software tool (written in C++) for studying the effects of penetrating injuries to personnel. This model is designed to simulate the wounding process and to predict injury outcomes in terms of performance degradation and survivability. As such, ComputerMan is being used in weapons assessment studies, as well as in vulnerability assessments.

ComputerMan is a model designed to simulate wounding and the resulting performance degradation, as well as threat-to-life, caused by fragment impacts. It can be used to establish the wounding power of fragments in weapons effectiveness studies, and to address vulnerability issues, such as the effectiveness of body armor. The human anatomy is represented and stored in the model in the form of 167 horizontal cross sections, each of which is further subdivided into 5mm x 5mm cells, resulting in a tissue database of 124,000 cells. Approximately 280 different tissue types are identified with a level-of-detail which includes nerves and blood vessels.

The anatomical description can be articulated so that the man can be seated in a crew compartment and thus be considered in a total weapon system assessment. This model draws upon an extensive database which includes information on 14 different projectiles ranging in mass from 0.5 grain to 225 grains, and includes 4 shapes and two densities. These data have been generalized and formulated into predictive models of tissue hole-size and projectile velocity retardation. Expert medical knowledge is also built into the model to relate wound description to injury severity and resulting limb dysfunction. Performance degradation is determined based upon combat role and time after wounding. Survivability predictions are based upon the Abbreviated Injury Scale (AIS).

The output can be used to determine the ability of a soldier to complete his assigned task, and the soldier's probability of survival. For grid-shots, curves can be developed for ranges of fragment parameters such as mass and velocity.

Equipment/Software Required:

Interactive, color workstation running X-Windows, with Motif libraries, and a C++ compiler. Batch: C++ compiler.

Input/Output Processing:

ComputerMan can be run either interactively or in batch mode. Four different modes of operation are: single-shot, grid-shot, live-fire test-shot, and point-burst-shot. Single-shot mode is used to process a single fragment shotline, and produce a resulting level of performance degradation and probability of survival. Grid-shot mode processes an array of parallel shotlines over a region of the body, and is used to develop average values of incapacitation and survival probability. Live-fire test-shot mode is used to analyze the results of live-fire tests where multiple impacts to the body are produced. Point-burst mode is used to simulate the cone of fragments produced from an exploding munition or from behind armor spall.

Output consists of levels of performance degradation for four common tactical roles (assault, defense, reserve, and supply) and six post-wounding times (30s, 5min, 30min, 12hrs, 24hrs, 5days). Probabilities of survival are also output.

Documentation:
Saucier, Richard, and Howard M. Kash III. "ComputerMan Model Description", ARL-TR-500, U.S. Army Research Laboratory, Aberdeen Proving Ground, MD, August 1994.

Stage of Development:
Version 2.1 of ComputerMan is currently available.

Validation:
ComputerMan has been effectively used in the prediction of Live-Fire Test (LFT) crew casualties and in the analysis of various types and configurations of body armor.

Comments:
Distribution of this tool is unlimited within DoD. Some distribution restrictions may apply to organizations outside of DoD. Please contact the POC for an availability determination.

How To Acquire:
Point of contact listed above.

Title: Cost Avoidance Methodology

Status: Available
Updated: July 2004

Owner/Sponsor Organization: Army Center for Health Promotion and Preventive Medicine (USACHPPM)
http://chppm-www.apgea.army.mil/

Point of Contact Information:

MAJ Timothy Kluchinsky
410-671-2925 DSN: 584-2925
timothy.kluchinsky@us.army.mil

General Overview:

Failure to eliminate or control health hazards can be costly to an organization. Uncontrolled exposures to health hazards may cause employee injury and illness and lost time. Health, Safety and Environmental staff professionals are more likely to obtain line management commitment to eliminate or reduce equipment or process hazards if they communicate both the health risk and associated health hazard costs. Managers who understand both health hazard costs and health risk are better equipped to make a decision on whether to eliminate or control a health hazard related to their equipment or process.

A methodology was developed to assist the U.S. Army estimate materiel system health hazard costs based on the probability of a hazard occurring and the severity of that hazard. Nine health hazard categories were crosswalked with potential medical outcomes. Incidence rates were researched and costs were calculated based on industry-wide injury, lost time, hospitalization and disability data. These costs were then related to the existing health risk indices. This information is used to provide a total cost related to hazards inherent in materiel systems. If abatement costs are provided, a cost effectiveness index (CEI) can be calculated. This should promote an increase in the reduction or elimination of health hazards.

This information is essential for the materiel managers so that determinations can be made as to the priority and feasibility of implementing the recommendations suggested to avoid the hazards inherent in a particular materiel system.

Equipment/Software Required:

Computer and MS Access software (version 97 or 2000). Computer, as a minimum, should be a 486, with 16 megabytes of RAM and a 680-megabyte hard drive.

Input/Output/Processing:

Information needed to calculate the cost avoidance figures include: number of systems in the Army inventory; number of people involved in the use of each system; risk category (high, medium, low); inherent hazards and their Risk Assessment Code (RAC); and hazard abatement costs if a CEI is desired.

The above information is entered into a cost calculator, and then the developed methodology prompts the user to respond to various questions; after the questions are satisfactorily answered, the methodology calculates the cost avoided for a single year and for the 20-year life of the system if the recommendations are implemented.

A report is generated which lists the dollar amount applicable to each specific hazard, and the number of exposures, injuries, and lost days involved with each hazard.

Documentation:

“Cost Estimating Model for Army Materiel Health Hazards Supporting Documentation”, CE416T3, Oct 98, Logistics Management Institute.

"Estimating Costs for Army Materiel Health Hazards", AR515R1, Mar 97, Logistics Management Institute.

Alternative/Comparable Approaches:
Environmental, Safety, and Health Management and Cost Handbook

Stage of Development:
Second version model upgrade currently in progress.

Comments:
Alternate POC: Ms Donna Kilpatrick, email donna.Kilpatrick@apg.amedd.army.mil DSN: 584-2925, Commercial: 410-436-2925

How To Acquire:
Point of Contact or alternate listed above.

Title: Crew Station Design Tool (CSDT)

Status: Available
Updated: January 2005

Owner/Sponsor Organization: Micro Analysis & Design, Inc.
http://www.maad.com

Point of Contact Information:
Wendy Bloechle
303-442-6947 FAX: 303-442-8274
sales@maad.com

Product Specific Web Site:
http://www.maad.com/index.pl/crew_station_design_tool

General Overview:
The Crew Station Design Tool (CSDT) allows designers to visualize and optimize their choices of controls and displays, and the position of those elements in a workstation. It automatically determines the optimum arrangement of controls and displays based upon sound human engineering and ergonomics principles. In order to accomplish this, the CSDT communicates with three different software tools: 1) Micro Saint Sharp - a task network modeling tool, 2) Open Inventor - a three-dimensional graphics environment, and 3) Jack® - a human figure (anthropometric) modeling tool.

Using the results of a task analysis as its foundation, the CSDT helps designers select the most appropriate control for a task and build a task network model of the activities performed in their desired workstation. Once executed, the task network model identifies operator-task conflicts and provides frequency-of-use data for each control and display. The CSDT uses this data to place the selected controls and displays in Open Inventor's three-dimensional environment. Finally, the suggested arrangement and the data acquired from the task network model are used to generate and execute a three-dimensional human figure model in Jack. Jack simulates the physical behavior of humans interacting in the workstation and allows designers to visualize the feasibility of certain tasks.

Equipment/Software Required:
Windows 98 and above Jack (optimal component)

Documentation:
User Manual

Stage of Development:
Available

Validation:
Some validation tests were performed for an airplane cockpit.

How To Acquire:
Alternate point of contact:
Brett Walters
Phone: 303-442-6947
Email: sales@maad.com

Title: Critical Tracking Task (CTT) Software

Overall Category: Tool
Update: August 2004

Owner/Sponsor Organization: Naval Air Warfare Center - Crewstation Technology Laboratory (CTL)
http://www.nawcad.navy.mil/service_area.cfm?prodarea_id=4

Point of Contact Information:

Richard S. Dunn, Ph.D.
301-342-9245 DSN: 342-9708 FAX: 342-9245
richard.dunn@navy.mil

General Overview:

Software to support Critical Tracking Task (CTT) methodology was developed by W.P.Gatewood, J.F. Antin, and R.S. Dunn, at the Crewstation Technology Laboratory, NAWCAD, Patuxent River, Maryland. The program is a multi-purpose laboratory standardized tracking task generator. There is a considerable amount of literature on the subject of critical tracking. The CTT is a dynamic tracking task with inherently unstable plant dynamics. The controller must provide input to maintain the closed-loop stability of the system. The plant dynamics of the task contain a difficulty factor, lambda, which is variable and adjustable under several program control options. Lambda determines the system's momentary instability and thus controls tracking task difficulty. The program has several possible uses, and is very flexible in that several parameters can be adjusted by the experimenter through menu control. Several different configurations can be saved, and test scenarios can be easily developed and executed.

There are two display modes from which to choose - compensatory and pursuit. The control input from the input device can be displayed in either case, and different target movement patterns and rates can also be selected in both display modes. The display can be operated in one or two dimensions. The area of cursor and target movement or error limits in x and y directions can be indicated by an ellipse, or the full screen can be used. The current time in seconds, error, and lambda values can all be displayed on the screen.

Several lambda factors can be selected. These are initial value, initial rate of increase, a second rate of increase, an error threshold which begins the second rate of increase, form of increase (i.e., linear or quadratic), and lambda values - and can be dynamically controlled via error feedback in several different ways. The software can produce fixed, variable, and adaptive or cross-adaptive tasks.

The value of lambda at which the operator loses control has been shown to be a reliable measure of operator skill for that particular set of task conditions. This allows for the CTT to be a useful tool in several situations. In a dual-task scenario, the CTT can be used as a loading task, a secondary task, or a primary task. The CTT can be used to classify an operator's psychomotor skills. The CTT software can also drive external displays and provide a method of evaluating alternative display information formats.

This software supports general purpose CTT methodology in an extremely wide range of potential applications.

Equipment/Software Required:

The CTT software is written in the C programming language, and runs on Silicon Graphics machines. A mouse or a joystick may be used as the input Device. Suitable computer connections allow many other configurations.

Input/Output/Processing:

The experimenter may set numerous features and parameters and save them to a set-up file. Several set up files can be placed together to produce a test scenario. The experimenter can easily begin a testing session by selecting and running the desired scenario file. Scenario control for the entire test operations is provided by the

software. The subject's information (RMS error, lambda values, and trial times) is stored in that subject's test file with a full record of system operating information and control input history data.

Data files are saved and available for future analysis, as well as or generating a report which summarizes that subject's performance. Included in the report are RMS error, final lambda, and time instability for each trial. A key feature of the software is that instantaneous performance error values (including running averages or exponentially time decayed running averages) can be linked to control the task difficulty in several ways. This permits a variety of adaptive task paradigms to be applied using the basic CTT logic. The result is a powerful and flexible process for tracking task methods. This software supports general purpose CTT methodology in an extremely wide range of potential applications.

Documentation:
Jex, Henry R. McDonnell, and Phatak, A.V., "A Critical Tracking Task for Manual Control Research", IEEE Tran., Vol. HFE-7, No.4, Dec. 1966,.pp. 138-145.

Stage of Development:
Complete.

Date Current Version Released:
1989

Validation:
The CTT was evaluated at the Crewstation Technology Laboratory, NAWCAD, Patuxent River, MD. A study comparing this digital form to analog versions previously used in manual control research (Jex, McDonnell, and Phatak, 1966) was conducted by J.F. Antin, W.P. Gatewood, Jr., and R.S. Dunn (1990), and referred to as the "Development and Evaluation of Digital Critical Tracking Task". The results showed subject performance was comparable with similar task parameters.

Comments:
In addition to the standard CTT, the program is capable of producing other plant dynamics. These include 0-3rd order, 1st order of exponential lag, and feedback modes in which the task varies in response to scored error performance. The experimenter can also set various gain values and user-selected constant time lags in the input, and plant dynamics computation.

How To Acquire:
To obtain, contact W. Pat Gatewood, Jr., Naval Air Warfare Center Aircraft Div., Code 4.6.4.6, 48110 Shaw Rd., Unit 5, Bldg. 2187, Patuxent River, MD 20670-5304; phone (301) 342-0009;
Email: GatewoodWP@nawcad.navy.mil

Title: D-CIDER

Overall Category: Tool
Update: January 2005

Owner/Sponsor Organization: Cognitive Technologies, Inc.
http://www.cog-tech.com/

Point of Contact Information:

Dr. Marvin S. Cohen
703-524-4331
mcohen@cog-tech.com

General Overview:

D-CIDER offers a more flexible alternative to standard decision models such as multi-attribute utility theory, which demands a large set of precise numerical assessments up front. D-CIDER is based on the philosophy that users may differ in what they know about what they want and in how they think about their preferences, and that their understanding may evolve as they work the problem. D-CIDER employs multiple strategies to assist the user in selecting decision options based on a multi-dimensional set of goals and preferences.

D-CIDER provides user-tailored support for selecting one or more options from a database, for example, personnel to hire, products to introduce, homes to buy, etc.

Equipment/Software Required:

D-CIDER runs on IBM PC, AT, and PS/2 compatibles; it requires 256K of memory, an enhanced graphics adaptor, and RGB color monitor. The system is written in C and Halo. It utilizes standard dBASE III files containing the options to be evaluated and their descriptions.

Input/Output/Processing:

Users may express their preferences in any of a variety of ways: by setting goals on one or more dimensions, by specifying trade-offs among criteria, and/or by directly evaluating a sample of the options. Trade-offs can be expressed by partially or completely rank-ordering criteria, by specifying exact or inexact importance weights, and/or by assessing the importance of some or all attributes relative to a standard. The implications of inputs in any format are displayed in all the other formats.

D-CIDER provides the user a choice of decision strategies, but guards against potential pitfalls in the user-selected approach. For example, the "eliminate" strategy screens options by user-set goals in order of their importance; this strategy is quite natural, but it may eliminate too many or too few options. If either problem occurs, D-CIDER uses prompts and a flexible spreadsheet-type display to help users revise their goals. For example, it prompts if options have been rejected because they just miss a goal on one dimension but are outstanding in other respects. The "justify" strategy enables users to work backwards from a tentative choice, determining whether the choice could be justified in terms of performance relative to other options. The "maximize" strategy utilizes whatever partial and imprecise tradeoff information the user has provided in order to calculate which options could be best. Users can employ multiple strategies, in any order.

D-CIDER provides a list of recommended options, based on user inputs and the selected decision strategy or strategies. The "maximize" strategy can be used to provide exact or inexact scores for each option; and the "justify" strategy can be used to generate a rationale for the choice.

Documentation:

Cohen, Marvin S., Laskey, Kathryn B., and Tolcott, Martin A., "A Personalized and Prescriptive Decision Aid for Choice from a Data Base of Options," Technical Report 87-18, Reston, VA; Decision Science Consortium, Inc., December 1987.

Alternative/Comparable Approaches:
None known.

Stage of Development:
A demonstration system has been completed, which implements a subset of the D-CIDER design. Limitations of the demonstration are: 1) it works with a maximum of seven criteria; 2) the capability for directly evaluating options is not yet implemented; 3) it still has a few bugs; and 4) the documentation is not yet complete.

How To Acquire:
Point of Contact listed above.

Title: Designer's Situation Awareness Toolkit (DeSAT)

Overall Category: Tool
Updated: August 2004

Owner/Sponsor Organization: SA Technologies, Inc.
http://www.SAtechnologies.com

Point Of Contact Information:

Dr. Mica Endsley
770-565-9859 FAX: 770-579-1132
Mica@SAtechnologies.com

General Overview:

The Designer's Situation Awareness Toolkit (DeSAT) aids designers in creating systems that support situation awareness (SA). The SA-Oriented design approach involves three phases: an analysis of SA requirements, the application of SA-Oriented design principles, and the measurement of SA during design evaluation. DeSAT provides support to the designer for each phase of the SA-Oriented design process through both tutorials and application specific tools (Figure 1).

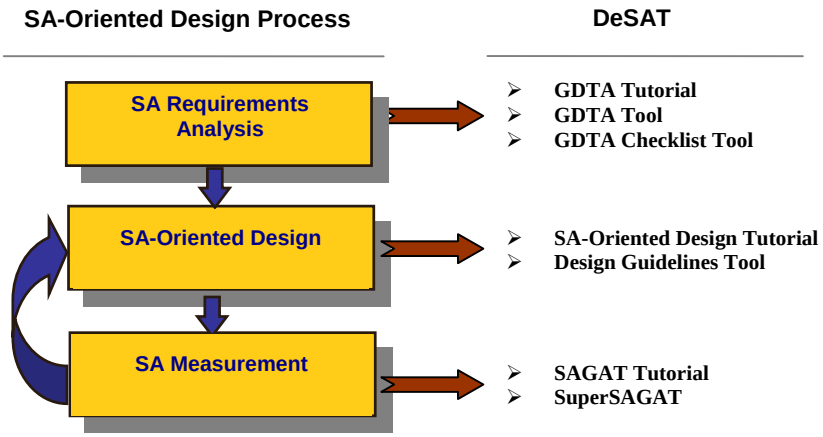

Figure 1: DeSAT tools support each phase of SA-Oriented Design

DeSAT supports the first phase of the SA-Oriented design process by providing a tutorial and two tools that aid the designer in understanding the user's SA requirements. The tutorial explains the Goal-Directed Task Analysis methodology, which is a systematic approach for delineating the user's SA requirements for a specific domain. Performing a GDTA is a complex and tedious endeavor and DeSAT further supports this process by providing the GDTA tool to assist designers in quickly and easily documenting the users' SA requirements. In conjunction with this tool, DeSAT provides a checklist tool that allows designers to evaluate a specific design or design concept to ensure that all of the relevant SA requirements have been addressed.

DeSAT supports the second phase of the SA-Oriented design approach by providing a tutorial that describes what it means to design systems that support SA. This tutorial is complemented by the Design Guidelines Tool which allows designers to easily access information and examples related to specific topics of interest.

Finally, the design process would not be complete without providing a way to evaluate the design concepts. To support this endeavor, DeSAT provides a tutorial describing the Situation Awareness Global Assessment Technique (SAGAT), as well as a tool that allows designers to quickly and easily create, modify, and administer SAGAT queries to users. This tool provides the additional benefit of collecting all test data automatically, thereby facilitating analysis of the experimental data.

As DeSAT supports the designer during each phase of the SA-Oriented Design process, it provides a comprehensive approach for improving the designer's ability to create and evaluate designs based on sound SA-Oriented design principles. It provides designers a new and innovative set of tools to assist in creating systems that effectively support the user's ability to build and maintain an adequate level of SA.

Equipment/Software Required:
DeSAT requires approximately 450 MB of memory to install the entire tool. However, sections of the tool can be installed separately to be used as needed. DeSAT performs best when 512MB of RAM and 600Hz processing speed are available. Additionally, MySQL and Wxpython software is required.

Documentation:
DeSAT includes a comprehensive user manual.

Stage of Development:
Available

Date Current Version Released:
August 2004

How To Acquire:
Contact POC above or visit the website www.SAtechnologies.com

Title: Digital Anthropometric Video Imaging Device (DAVID)

Overall Category: Tool
Update: August 2003

Owner/Sponsor Organization: Naval Aerospace Medical Research Laboratory (Code 66452)
http://www.namrl.navy.mil

Point of Contact Information:

Mr. Jack L. Saxton
850-452-2557 DSN: 922-2557
jack.l.saxton@navy.mil

General Overview:

The Digital Anthropometric Video Imaging Device (DAVID) is a computer-based method of obtaining conventional measurements of the human body. DAVID requires a computer, frame-grabbing hardware, digitizing software, and camera(s). An image of the person to be measured is acquired and digitized to obtain the measurement. Because DAVID is a computer-based system, the full potential of this technology is difficult to project; however, a few advantages of DAVID have been identified

1) Flexibility: DAVID's images can be acquired at a remote location and sent electronically, using networking capabilities, to a central site for digitizing, quality control, storage, and entry into a database

2) Compatibility: DAVID, in conjunction with modeling software, offers the capability of electronically transferring measurements in real-time applications for screening personnel and for design criteria.

3) Quality Control: DAVID, a computer-based system, accommodates review of files for not only accuracy of measurement, but also verification of proper subject positioning

4) Portability: DAVID can be moved easily to sites where the subject population is located.

5) Graphic Report: A DAVID image file provides easily understood graphic representations of each measurement taken.

6) Inexpensive: DAVID's components are off-the-shelf items.

7) Minimal Training: DAVID requires manipulating a mouse controller to digitize and measure an image.

Uses:

- Anthropometric personnel screening
- Anthropometric survey
- Garment design/fitting
- Human factors
- Design of transportation equipment, furniture, etc.
- Growth/weight-loss studies

Since DAVID is computer-based, the output can be varied. Generally, a report containing the image with anthropometric measurements would be included in the most basic output; however, other outputs could include interfacing with 3-dimensional modeling software, or real-time anthropometric screening of personnel.

Equipment/Software Required:

- PC
- Frame-grabbing board

- Digitizing software
- One or more cameras

Input/Output Processing:
The system must be calibrated before meaningful measurements can be obtained. Calibration is performed for each of the cameras by digitizing an object of known dimensions that is also a known distance from the camera. The only other inputs required from the operator would be a file-naming system selection and a sequence of keystrokes/mouse operations to obtain and digitize the image.

Once the image is acquired, digitizing software is used to electronically measure the subject. Limits of the area to be measured are defined by moving the mouse cursor to the exact location to start the measurement, and then moving it to the location where the measurement is to terminate. The software automatically calculates distance (in the preferred units of measurement) based on the previously performed calibration. Each value can be electronically copied to a database for statistical analysis/evaluation and storage.

The output from DAVID is compatible with the Internet, network, hard copy, floppy disc, writeable CD, or any other media suitable for data transfer.

Documentation:
NAMRL Special Report 02-1, "A Digital Anthropometric Video-Imaging Device (DAVID) Operation Manual," *JL* Saxton and FR Patterson, Naval Aerospace Medical Research Laboratory, Pensacola, Florida, provides detailed instructions for the operation of the DAVID.

Alternative/Comparable Approaches:
Currently, two major alternative approaches are available for obtaining anthropometric measurements. One is the manual technique, which requires the use of anthropometers; and the second is a 3-dimensional laser scanning apparatus.

Stage of Development:
By the end of 2000, the DAVID technology has replaced the existing method used by the Navy to anthropometrically screen aviation candidates.

Validation:
Two validation studies have been completed to assess accuracy, reproducibility, and comparability of DAVID technology. One of these studies was designed to assess accuracy and reproducibility of the DAVID technique when compared with other methods of measurement. When sitting height was measured for one person by 15 different people using different measurement techniques, DAVID and the manual (anthropometer) techniques produced the same mean. In another study, eight measurements (sitting height, sitting eye height, sitting acromial height, thigh clearance, buttock/knee length, sitting knee height, hip width, and bideltoid breadth) were made on 240 people using both DAVID and manual techniques; the results showed a high level of correlation between the measurements. These studies provide verification that DAVID is a viable alternative to existing anthropometric measuring methodologies.

How To Acquire:
Point of Contact listed above, or:
Other POC: F. R. Patterson, LCDR, MSC, USN
Com.: 850-452-4656 / DSN 922-4656
E-mail: patterso@namrl.navy.mil
(Same address as above.)

Title: Energy Expenditure (Metabolic) Prediction Program (EEPP)

Overall Category: Tool
Updated: August 2004

Owner/Sponsor Organization: University of Michigan – Office of Technology Transfer
http://www.techtransfer.umich.edu/

Point of Contact Information:

Mr. Doug Hockstad
734-615-4004 FAX: 734-936-1330
dhocksta@umich.edu

Product Specific Web Site:
http://www.engin.umich.edu/dept/ioe/ENGEXP/

General Overview:
The Energy Expenditure Prediction Program is based on the assumption that a job can be divided into simple tasks (activity elements) and that the average metabolic energy rate of the job can be predicted by knowing the energy expenditure of the simple tasks and the time duration of the job. The EEPP software is a user-friendly tool, is more accurate than selecting values from a standard table, and it's more feasible and less costly than laboratory techniques involving measurement of oxygen consumption. Its techniques involve measurement of oxygen consumption. It is the result of research at the University of Michigan's highly regarded Center for Ergonomics, and is in use at sites all over the world.

The EEPP is useful in ergonomic job analyses, designing jobs, comparing task methods, evaluating job improvements, and identifying tasks requiring high energy. Therapists, physicians, researchers, and others who evaluate and design jobs use EEPP to help prevent worker fatigue, design new jobs, and evaluate changes to existing jobs.

Equipment/Software Required:
PC with Windows 95, 98, 2000, NT 4.0, or XP.

Input/Output/Processing:
I. Subject's gender and weight.
II. List of activity elements (e.g., lift, push, carry).
III. Parameters specific to the activity elements (e.g., frequency, weight of load, distance carried).

I. Listing of activity elements with their corresponding energy expenditure.
II. Calculation of the total energy expenditure rate for the job (Kcal/minute).
III. Data can be viewed on screen, printed, or written to a file.

Documentation:
Garg, A., Chaffin, D.B., and Herrin, G.D., "Prediction of Metabolic Rates for Manual Materials Handling Jobs." American Industrial Hygiene Association Journal, 1978, Vol. 39, No. 8, p. 661-674.

Program has an Internet Help Feature.

Alternative/Comparable Approaches:
Energy estimation model sponsored by Motor Vehicle Manufacturing Association.

Stage of Development:
Currently available Version 2.0.5

Date Current Version Released:
June 2004

Validation:
Validation studies have been conducted. Please contact POC for more specific information.

How To Acquire:
Point of Contact listed above.

Title: ErgoImager

Overall Category: Tool
Updated: July 2004

Owner/Sponsor Organization: NexGen Ergonomics, Inc.
http://nexgenergo.com/ , www.humancad.com

Point of Contact Information:
Mr. David Pinchefsky, President
514-685-8593 FAX: 514-685-8687
pinchefsky@nexgenergo.com

Product Specific Web Site:
http://www.nexgenergo.com/ergonomics/ergoimager.html
http://www.humancad.com/products/ergoimager.html

General Overview:
ErgoImager is a Windows-based ergonomic design and job-analysis program.

ErgoImager™ is a unique 2D/3D translation tool that allows you to perform 3D biomechanical analysis using 2D digital images.

ErgoImager allows users to import digital images and superimpose a 3D mannequin using various translation techniques and technology from our ManneQuin technology (which includes ManneQuinBE, ManneQuinPRO and ManneQuinELITE) and then interface with University of Michigan 3D SSPP model (3D SSPP). ErgoImager provides reports with the original image, mannequin in the posture matching the image and selected results from the 3D SSPP.

ErgoImager is used in Human Factors design and ergonomic job evaluations.

Equipment/Software Required:
IBM PC or compatible with W95/98/Me/NT/W2000/XP.

Input/Output/Processing:
Data input is an digital image and data pertaining to the lift/task to be analyzed.

Various ergonomic and biomechanical results depending on function selected.

Documentation:
Manual and on-line help.

Stage of Development:
V 1.0

Date Current Version Released:
2004

How To Acquire:
Point of Contact listed above.

Title: ErgoIntelligence-MMH & UEA Suites

Overall Category: Tool
Updated: July 2004

Owner/Sponsor Organization: NexGen Ergonomics, Inc.
http://www.nexgenergo.com

Point of Contact Information:

Mr. David Pinchefsky, President
514-685-8593 FAX: 514-685-8687
pinchefsky@nexgenergo.com

Product Specific Web Site:
http://www.nexgenergo.com/ergonomics/ergointelmmh.html
http://www.nexgenergo.com/ergonomics/ergointeluea.html

General Overview:
ErgoIntelligence-MMH (Manual Material Handling) is a series of software modules for a variety of ergonomic analysis and design applications. The manual material handling modules focus on material handling applications and provide an in-depth risk analysis for low back injuries using the NIOSH lifting equation, biomechanics, energy expenditure, Mital tables, and Snook and Ciriello tables.

The ErgoIntelligence™ Upper Extremity Assessment (UEA) suite of tools incorporates a variety of tools including RULA, REBA, Strain Index, Occupational Repetitive Actions Index (OCRA) and the Cumulative Trauma Disorders Risk Index.

ErgoIntelligence is used in ergonomic job evaluations.

Equipment/Software Required:
IBM PC or compatible with W95/98/Me/NT/W2000/XP.

Input/Output/Processing:
Data input depends on analysis being performed and software prompts for this information.

Various ergonomic and biomechanical results depending on function selected.

Documentation:
Electronic manual and extensive on-line help.

Stage of Development:
MMH Version 1.3, UEA Version 1.4

Date Current Version Released:
2003

How To Acquire:
Point of Contact listed above.

Title: ErgoMaster

Overall Category: Tool
Updated: July 2004

Owner/Sponsor Organization: NexGen Ergonomics, Inc
http://www.nexgenergo.com/

Point of Contact Information:

Mr. David Pinchefsky, President
514-685-8593 FAX: 514-685-8687
pinchefsky@nexgenergo.com

Product Specific Web Site:
http://www.nexgenergo.com/ergonomics/ergomast.html

General Overview:
ErgoMaster is a suite of software modules that enables users to incorporate video and photographic images from a variety of sources. The tools include biomechanics, NIOSH lifting equation, and RULA. An interface to the University of Michigan's 3D SSPP in 2D mode is available thru the Biomechanics Analyst module.

ErgoMaster is used for ergonomic job evaluations.

Equipment/Software Required:
IBM PC or compatible with W95/98/Me/NT/W2000/XP.

Input/Output/Processing:
Data input depends on analysis being performed and software prompts for this information.

Various ergonomic and biomechanical results depending on function selected.

Documentation:
Manual and on-line help.

Stage of Development:
V 3.5

Date Current Version Released:
2003

How To Acquire:
Point of Contact listed above.

Title: Ergoweb JET Software™ 4.0 (Job Evaluator Toolbox™ 4.0)

Overall Category: Tool
Updated: July 2005

Owner/Sponsor Organization: Ergoweb, Inc
http://www.ergoweb.com/

Point of Contact Information:

Mr. Chad Mortenson
435-654-4284 FAX: 435-654-5433
cmortenson@ergoweb.com

Product Specific Web Site:
http://www.ergoweb.com/software/jet/

General Overview:
The Ergoweb's JET (Job Evaluator ToolBox) software is made up of a suite of 13 ergonomic job evaluation methods. These methods are used to identify and control ergonomic concerns, including, but not limited to, manufacturing, warehousing, assembly, and office facilities. JET software consists of peer reviewed, published methodologies recognized and used by professionals, yet it is very easy to use and understand by users of all skill levels.

JET Software is the first comprehensive suite of ergonomic workplace evaluation and control tools available. It uses a simple web-based interface that allows users to run the software over a variety of operating systems.

JET Software is available on a subscription basis.

- Save money and time while performing ergonomic evaluations
- Professionally accepted tools optimized for ease and speed via the internet
- Printable, customizable reports
- Ergonomic references and user manual built into the software
- Software easily allows ergonomic, interventions and design implementation to be conceptually tested
- Data collection sheets for each tool
- Upload data from previous analysis

Manual material handling
- 2-D static strength biomechanical models
- Two metabolic (energy expenditure) models
- NIOSH revised lifting equation (1991)
- Acceptable weights for lifting/lowering
- Acceptable forces for pushing/pulling
- Acceptable weights for carrying
- ACGIH TLV
- Muscle fatigue analysis
- AAMA
- Checklists

Valuable instructional and background materials, survey and Checklist forms
- Principles and ergonomics
- Basic anthropometry
- Survey forms
- Hazard identification, evaluation and control methods

This set of tools may be used for ergonomic task and job analysis, and to perform reliable, valid, credible, and professional job analysis and designs/redesigns.

The outputs are used to identify, prioritize, and control ergonomic concerns.

Equipment/Software Required:
This software can be accessed on a subscription basis via the Web, delivered as an intranet (served from Windows 95, 98, 00 or higher, Windows NT, or UNIX). For Web subscriptions and Intranet installations, each user must have web browser software installed (e.g., Netscape, Internet Explorer).

Input/Output/Processing:
The inputs depend on which of the 12 different tools are used. In general, the inputs include postural information (joint angles), applied forces, hand locations at the beginning and end of a lift, frequency and duration, weights of objects, velocity of walking, and other observable task information.

Depending on which of the 12 tools is being used, the processing includes peer-reviewed-and-published algorithms for static biomechanical analysis, metabolic analysis, NIOSH Revised Lifting Equations, NIOSH Work Practices Guide, and Liberty Mutual ("Snook") and table data lookups. The software utilizes C++ and Java programming languages.

Each of the 12 tools produces a report summarizing all data inputs, calculations, and, where applicable, engineering and administrative control suggestions where a potential ergonomic concern is detected. Reports are customizable, wherein the analyst can add such things as job descriptions to produce a final report for presentation.

Documentation:
Extensive documentation is provided online. Each tool is accompanied by detailed documentation describing when and how to apply the tool, how the tool works, any assumptions or limitations, and how to collect data for the analysis.

Alternative/Comparable Approaches:
Subsets of this "Toolbox" exist as separate products, such as the NIOSH Revised Lifting Equations, 2-D Biomechanical Analysis, and metabolic analysis. However, there is no similar product that combines all of the tools in one package, complete with extensive documentation, and with simple design/redesign guidance when a problem is detected.

Stage of Development:
Complete; however, the product is upgraded on an annual basis, adding new methods and improving upon existing ones. This is a key benefit of the subscription-based model; all updates are delivered seamlessly and in real-time.

Date Current Version Released:
February 1, 2005

Validation:
All tools are based on published, peer-reviewed sources. Software validation is performed in-house.

Comments:
For more information, please visit www.ergoweb.com or call toll free 888-374-6932.

How To Acquire:
Point of Contact listed above or call toll free 888-374-6932.

Title: Expert System for Test Program Set Quality Assurance (ESQA)

Status: Available
Update: February 2005

Owner/Sponsor Organization: Prospective Computer Analysts, Inc.
http://www.pcaonline.net/

Point of Contact Information:

Mr. Greg Winter
516-742-9100 x 107
gwinter@pcaonline.net

General Overview:
ESQA is an expert system that automatically analyzes Test Program Source code for quality metrics. ESQA generates 23 quality reports. ESQA is available to government agencies and/or commercial businesses.

ESQA is used in the development and procurement of test programs. Now used by U.S. Navy to analyze Test Programs. Also used in the Test Program acceptance process. May be used by any organization to rapidly review and manage Test Program development efforts.

Equipment/Software Required:
Pentium III or better / 128MB RAM / 8MB Hard Disk space / Windows 98, 2000, NT, or XP.

Input/Output Processing:
Test Program Source Code in ASCII format.

ESQA extracts data from the Test Program source code using a front-end parser, which processes the code like a compiler. The extracted data is then input to a Microsoft Access database. A Graphic User Interface (GUI) and various functions in Visual Basis are used to process the data, and Crystal Reports is used to format and output the final reports.

ESQA generates 23 quality reports for each TPS, including Fault Isolation Percentage, TPS structure analyses, test efficiency, test accuracy and many others.

Documentation:
Full-color user's manual and online help functions.

Alternative/Comparable Approaches:
There is no other comparable product currently available. The only other approach is to manual code inspection.

Stage of Development:
A fully mature product in development since 1991. Commercial Release version 4.0 provided to all users in May 1996. Fully updated and refined for operation in all Microsoft operating system environments. Represents the state of the art in Test Program automated analyses.

Date Current Version Released:
Latest version released July 2005

Validation:
Validated under a report developed under contract N68335-92-D-0226, D.O.-007, "Quality Assurance Analysis of F14D WRA OTPS Software, an OP-EVAL Report Evaluation Project 778-OT-IIIA"

Comments:
ESQA has been used on more than 500 Navy, Air Force, Army and commercial TPSs. ESQA is installed at 9 DoD and numerous commercial sites. ESQA was developed under the Small Business Innovation Research Program (SBIR).

How To Acquire:
Point of Contact listed above.

Title: Fatigue Avoidance Scheduling Tool (FAST)

Overall Category: Tool
Updated: March 2005

Owner/Sponsor Organization: Air Force Research Laboratory, Human Effects Directorate
http://www.he.afrl.af.mil/

Point of Contact Information:

Steven R. Hursh, Ph.D.
Science Applications International Corporation/NTI, Inc.
443-402-2701 FAX: 443-402-2776
hurshs@saic.com

General Overview:
FAST is a fatigue forecasting system developed and by NTI (and SAIC) under a small business innovative research (SBIR) grant from the US Air Force and further support by the US Department of Transportation. Fatigue predictions are derived from the Sleep, Activity, Fatigue, and Task Effectiveness (SAFTE(tm)) model invented by Dr. Steven Hursh of SAIC. The SAFTE(tm) model has received a broad scientific review and the DoD considers it the most complete, accurate, and operationally practical model currently available to aid operator scheduling. The Department of Transportation is in the second phase of a three-phase project to validate and calibrate the model for avoiding excessive fatigue in transportation operations. The FAST scheduling tool uses the model to compare schedules in terms of predicted performance effectiveness. FAST allows easy entry of proposed schedules and generates graphical predictions of performance along with tables of estimated effectiveness scores for objective comparison. Optimal schedules may be selected based on average effectiveness for proposed work periods or mission critical events.

The tool may also be used for retrospective analysis of fatigue related factors that may have contributed to an accident, error or safety related incident. In this mode, information on the work and sleep schedules of operators prior to the event may be entered into the tool and a projection of performance effectiveness at the time of the event is determined. In combination with other information, this analysis can project the combined effects of time of day and sleep history as a contributing factor to safety related events.

An algorithm is included with FAST that can infer likely sleep patterns when only the work schedule or mission demands are known. This AutoSleep feature uses adjustable rules to insert reasonable sleep patterns into a regular or irregular work schedule. Using AutoSleep, FAST can be used to project performance under any anticipated work schedule or to estimate performance at the time of an accident based on work history.

Specialized features for flight operations are included that allows entry of waypoints and computation of location and sunlight conditions. Critical mission events can be entered for point estimates of effectiveness, such as for mid-air refueling and over the target. A mission time line of effectiveness, waypoints, interpolated locations at each point in the schedule, sunlight conditions, critical events, and projected sleep/nap times can be printed.

Equipment/Software Required:
Windows-based PC processing.

Input/Output Processing:
Input: Work and/or sleep schedule information or actigraph sleep estimation data. Work and/or sleep schedule information may be read from a file or input either graphically or using a tabular entry screen.

Output: Graphs and tables of estimated effectiveness and summary statistics. A mission timeline is available for flight operations. All screens may be copied to the clipboard and pasted into Excel or Power Point.

Documentation:
Currently, embedded help and Getting Started Guide.

Alternative/Comparable Approaches:
None currently available with same features.

Stage of Development:
Version 1 available for government use and commercial evaluation.

Validation:
Predictions of model have been validated against laboratory data. Studies are underway with the Air Force and the Federal Railroad Administration to test predictive validity for on the job performance.

How To Acquire:
Mail: Steven R. Hursh, Ph.D.
Program Area Manager, Biomedical Modeling and Analysis
Science Applications International Corporation
Mail Stop MS23
3465 Box Hill Corporate Center Dr.
Abingdon, MD 21009

Title: Frequency Weighted Task Complexity Index (FWTCI)

Overall Category: Tool
Updated: August 2004

Owner/Sponsor Organization: Naval Air Warfare Center - Crewstation Technology Laboratory, CTL
http://www.nawcad.navy.mil/service_area.cfm?prodarea_id=4

Point of Contact Information:

Dr. Richard S. Dunn
301-342-9245 DSN: 342-9245 FAX: 301-342-9708
richard.dunn@navy.mil

General Overview:

The FWTCI is a data processing method supported by custom software developed at the Navy's Crewstation Technology Laboratory, NAWC-AD, Patuxent River, MD. The process is applicable to any time varying data stream, but the focus and most of our experience has been with behavioral output data such as manual control movements and task-related eye movements. The initial objective was a machine scored parameter to characterize activity level and to detect major style variations. The FWTCI provides this and with experimental controls also gives sensitive and effective measures of operator skill, effort, or workload.

The main characteristics of the FWTCI are:

- It's a real-time or near real-time data process for simulation and system test and evaluation.
- It produces pictorial output for visual inspection.
- It permits evaluation of both time domain and frequency domain aspects of the data.
- It is not referenced to optimal path or forcing function aspects of the task.
- The result is highly sensitive to shifts in operator style, activity, strategy, or effort

Results are useful for tests with smaller numbers of subjects and test trials. Numerical summary scores are available for scaling and statistical inference testing. The process has potential to be standardized to permit comparability between different test conditions, in cross-modality comparisons, and for normative data comparisons

The FWTCI process has three graphic parts. A reference example is a laboratory tracking task which starts as a very easy single axis compensatory tracking task and slowly increases in difficulty until it is finally uncontrollable. The initial data product is a strip chart, always included for inspection. It shows stick position versus time. The second process product is a Perspective Spectral Array (PSA) for direct visual inspection. Spectral analysis with the Fast Fourier transform produces the PSA. Using part of the input data, usually 8 to 12 seconds worth, a "moving window" process generates the spectral analysis for a small portion of the record, plots it in the corresponding time slot, and then moves through the data in one second increments to cover the entire record. Plotted in this fashion, the result is a transform of the initial data which shows time domain and frequency domain signal characteristics of the original performance. Task complexity, activity level, and any basic change in operator strategy at different times and frequency bands can be seen directly. Any meaningful periodic content in the operator output or "signal" can be identified for further investigation. (Strong individual style influences are visible in these records and can easily support visual discrimination of originator with high accuracy). The third record or product of the process is the actual Frequency Weighted Task Complexity Index. It is a further transform to summarize the PSA across frequencies and return to a single variable plotted against time. The PSA frequency magnitude values are summed with scaling and gain adjustments. Scale and gain values are selected for each application to normalize the data to scale of 100 and to adjust the spread of variations in a particular batch of data. The FWTCI indicates operator task output and workload resulting from increasing task demands. (For figures to illustrate this explanation, contact the originator.)

The general requirements for test or experiment control conditions to use the FWTCI are sensible and straightforward. If operator output reflects task demands and if causal independent variables are altered only one at a time, then the FWTCI provides an effective, interoperable and sensitive measure of task complexity, effort, or skill. The moving window FFT procedure is analogous to a moving average technique. It has the effect of smoothing out the noisy signal data, and more clearly indicating periodic events in the record with duration comparable to the window time length or behavioral "epoch" length. Rightward movements of the FWTCI - larger FWTCI values - result from signals with more frequency composition elements and at higher strength. The FWTCI has been seen to be stable for individuals, and highly consistent across individuals. Even though different test subjects may have very different baseline values as a result of variations in style or approach, specific task demand changes usually produce highly consistent changes in the corresponding FWTCI measures. This means the measure is both sensitive and consistent across test subjects, a rarity in behavioral test measures.

The FWTCI data process provides a quantified means of measuring individual performance on various tasks that can differ in situational awareness, symbology, decision aiding, and task demands for workload or operator effort, etc. Useful in rapid prototyping situations where it is necessary to systematically change or assess many parameters.

Equipment/Software Required:
The FWTCI is original LISP software, now revised to C++ for computers using a UNIX operating system.

Input/Output Processing:
The FWTCI data process is applied to time history records, usually some type of continuous performance input such as found in driving a car or flying an aircraft. It may be applied to any time varying signal that is single-valued for each sample interval. For multi-axis manual control tasks, simple combinatorial operations may be applied to generate a single-valued variable. Applications at NAWC-AD-PAX have centered upon continuous manual control tasks and eye movement records.

FWTCI uses a Fast Fourier Transform (FFT) for a portion of the record in a moving window technique to score changes in activity over time. FWTCI has three graphical outputs. The first is a strip chart showing the parameter under study vs. time, the second, a spectral array showing power as a function of time and frequency, and lastly, the FWTCI which summarizes power for all frequencies as a function of time.

Documentation:
The supporting software is not documented at this time. Brief descriptive material is available from the listed POC.

Dunn, R.S. "Frequency Weighted Task Complexity Index Assessment of Improved Carrier Optical Landing System Data," Contributory Report of CTL test results to Strike Aircraft Directorate, (1993).

Dunn, R.S., Editor, Dunn, R.S., Grable, C., Yglesias, C. "Installation and Assessment of the CAE Advanced Fiber Optic Helmet Mounted Display System." NAWCADPAX-95-270-TM, (1995).

Dunn, R.S., McBride D., "Frequency Weighted Task Complexity Index, an Improved Metric for Man-Machine Integration." Paper presented at the 42nd Meeting of the Department of Defense Human Factors Engineering Technical Advisory Group, Washington, D.C., (1999).

Alternative/Comparable Approaches:
The FWTCI is unique.

Stage of Development:
Originally written in LISP, FWTCI has been converted to C++. Documentation is incomplete, and the expected development of frequency weighting coefficients (considered desirable for several reasons) has not been accomplished. But the current product is useful in present form.

Date Current Version Released
1989

Validation:
The FWTCI has been applied in numerous test and evaluation tasks of the Crewstation Technology Laboratory with excellent and interpretable results.

Comments:
The FWTCI process is a new and widely applicable data processing method for assessment of primary task performance. It's potential as a crewstation design support measure of effectiveness and as a training measure of effectiveness has been established in numerous manual control tracking task applications. In these capacities it can help evaluate, refine and tailor mission effectiveness for an extremely wide range of products wherever man-machine testing is relevant. Since it is a computer-based score to start with, it may be extendable in computerized systems to serve as a means to gate or modulate processes, recognize operator states or capabilities, and allow automation to interface smoothly with operator inputs. The FWTCI offers faster, better and more effective ground, simulation and flight testing wherever the issues center on human performance or task demands and require us to evaluate manual control, body movement, and head or eye movement data. Since the prime software requires a UNIX environment supporting LISP operations, the Crewstation Technology Laboratory offers to run limited amounts of sample data for interested parties so that the applicability of FWTCI can be evaluated.

How To Acquire:
To obtain, contact POC listed above, or:
W. Pat Gatewood, Jr.
Naval Air Warfare Center Aircraft Div., Code 4.6.4.6
48110 Shaw Rd., Unit 5, Bldg. 2187
Patuxent River, MD 20670-5304
phone (301) 342-0009
Email: GatewoodWP@nawcad.navy.mil

Title: Generator of Body Data (GEBOD)

Overall Category: Tool
Update: December 2004

Owner/Sponsor Organization: Air Force Research Laboratory
http://www.afrl.af.mil/

Point of Contact Information:

Dr. Joseph Pellettiere
937-255-1150 DSN: 785-1150
joseph.pellettiere@wpafb.af.mil

General Overview:
The GEBOD program provides the data needed by the Articulated Total Body (ATB) model to describe the human or manikin occupant.

GEBOD will generate the body segment and joint properties for any size male or female based on their height and weight. It will also provide child data based on age, height, and weight. GEBOD was designed specifically to provide the body data needed by the ATB program for human body dynamic simulations. The data provided can be used by other similar programs and in applications where the body link and mass properties are needed.

Equipment/Software Required:
The GEBOD program was written in FORTRAN77. It runs on most computers with a FORTRAN compiler, including personal computers, workstations, and mainframes.

Input/Output Processing:
GEBOD is an interactive program, asking several basic questions about the body to be generated, such as gender, height, and weight.

Regression equations based on height and weight are used to calculate the body data for adult males, adult females, and children for these data sets. The regression equations have been developed from anthropometric surveys and stereophotometric data.

GEBOD creates a model consisting of fifteen or seventeen links connected in a tree structure representing the human or manikin body. The body is provided in two files: a report file containing a list of the human body dimensions and labeled tables containing the body data; and an input file formatted for the ATB program. The body data sets include the body segments' geometric and mass properties, and the joints' locations and mechanical properties.

The output data file generated by GEBOD can be inserted directly into an ATB input file.

Documentation:
Cheng, H., Obergefell, L., and Rizer, A., "Generator of Body Data (GEBOD) Manual," Armstrong Laboratory Report No. AL/CF-TR-1994-0051, Wright-Patterson Air Force Base OH, March 1994.

Stage of Development:
Complete and operable with revisions released periodically.

Date Current Version Released:
Version 5.1 released 7/2000

Validation:

Validation of the Hybrid II and Hybrid III dummy datasets generated by GEBOD is documented in: Obergefell, L.A., Kaleps, I., and Steele, S., "Part 572 and Hybrid III Dummy Comparison Sled Test Simulations," SAE Paper No. 880639, February 1988.

How To Acquire:
Point of Contact listed above.

Title: HARDMAN Comparability Methodology (HCM)

Overall Category: Tool
Update: March 2005

Owner/Sponsor Organization: Defence Research and Development Canada
http://www.toronto.drdc-rddc.gc.ca/

Point of Contact Information:
Mr. Keith Hendy
416-635-2074 DSN: 827-2074 FAX: 416-635-2013
keith.hendy@drdc-rddc.gc.ca

General Overview:
The IP/PCT model provides an integrating framework for understanding the origins of operator workload and the relationship of workload to concepts such as cognitive compatibility and situation awareness. It provides insight into individual and team decision making. The IP/PCT model can be given quantitative form, as is demonstrated in the Integrated Performance Modeling Environment (IPME) software for task network analysis (see entry for IPME, DDSM0162).

As a framework for understanding operator information processing limitations and their impact on perceptions of workload, error production, and performance the IP/PCT model can be encoded for embedding software for task network simulation. It is not a trivial activity to code the full model into standard software, such as Micro Saint; however, the IP/PCT model has been incorporated into a commercially available software environment (IPME from Micro Analysis and Design -- as above, see entry for IPME).

The IP/PCT model has been used as a framework for designing a new approach to Crew Resource Management (CRM) training. From the IP/PCT model, a behaviorally anchored rating scale has been devised to assess resource management performance in terms of the timeliness and appropriateness of decisions and the overall management of time, knowledge, and attention. The IP/PCT model can be used in performance prediction tools that fulfill the activities recommended in a MIL-HDBK-46855 front-end human engineering analysis and has anchored the development of a tool (SERA) for accident analysis and investigation.

Analyst Qualifications: 1-5 yrs. HFE experience; familiarity with the literature on operator workload.

Input/Output/Processing:
As a descriptive model, no quantitative data are required. When embedded in a program for task network analysis, certain data describing the tasks and task sequences are required. This is described in the SOLE/IPME entry (see DDSM0162).

Through a simple application of information processing theory, the IP model reduces all workload effects to their action on the amount of information to be processed, or the time available for processing. Various diffusely acting psychological and physiological stressors are claimed to affect the rate at which information can be processed (in bits per second), and so affect decision times. For most applications of the IP model, it is only necessary to accept the underlying concepts of the model. It is not necessary to actually measure the amount of information being processed for the model to be useful. The PCT models are complementary. The IP model sits within the PCT framework at all points where information is actively processed.

The IP/PCT model integrates most factors that one associates with operator workload and situation awareness into their effect on time, knowledge, and attention. These three factors are inextricably bound up so that they always trade-off, one against another. The IP/PCT provides a framework for understanding how human information processing limitations impact on performance. When used in the qualitative sense, this knowledge is

the output. When used as a predictive model, say, in a task network simulation, the IP model provides a metric of operator workload and performance.

Documentation:
Hendy, K.C. and Farrell, P.S. (1997), "Implementing a Model of Human Information Processing in a Task Network Simulation Environment" (DCIEM 97-R-71), North York, Ontario, Canada: Defence and Civil Institute of Environmental Medicine.

Hendy, K.C., Liao, J. and Milgram, P. (1997), "Combining Time and Intensity Effects in Assessing Operator Information Processing Load", Human Factors, 39(1), 30-47.

Hendy, K.C., Liao, J., and Milgram, P. (1994). Combining time and intensity effects in assessing operator information processing load. (Submitted to Human Factors).

Alternative/Comparable Approaches:
Multiple Resource Theory, W/INDEX, Wingert's functional interface method. The IP/PCT model incorporates aspects from many models, and, therefore, is both comparable to and different from these other approaches at the same time.

Validation:
For information regarding the following validation studies, please contact the POC: East, K.P., Hendy, K.C. and Matthews, M. (1996), "Validation of an Information Processing-Based Model for Workload and Performance Prediction", in Proceedings of the Human Factors Society of Canada, 29th Annual Conference, Mississauga, Ontario, Canada: Human Factors Association of Canada, 155-160.

Hendy, Liao and Milgram (1997) (see DOCUMENTATION, above).

How To Acquire:
Point of contact listed above.

Title: iGEN™ Cognitive Agent Software Toolkit

Overall Category: Tool
Updated: August 2004

Owner/Sponsor Organization: CHI Systems, Inc.
http://www.chiinc.com/

Point of Contact Information:

CHI Software, Inc.
Derek Wischusen, iGEN™ Marketing
215-542-0274
derek@chisoftware.com

Product Specific Web Site:
http://www.cognitiveagent.com/

General Overview:
iGEN lets you build intelligence into your IT infrastructure and process automation, whether for training, performance support, or simulation. By emulating human decision-making processes and problem-solving skills, iGEN™ helps you capture knowledge in the terms your people understand and your systems use.

The iGEN™ cognitive engine uses an architecture based on cognitive research, but the architecture minimizes the number of 'built-in' psychological theories. As a result, it has retained an open architecture which allows different component-level theories (e.g., of vision, audition, grasp/reach, memory decay, and so on) to be built and inserted into specific applications as needed and desired by the end-user.

The iGEN™ cognitive engine, called BATON, is an implementation of a broader framework for modeling human information processing. That framework is described in the research literature under the name COGNET. The various publications and white-papers on the iGEN™ web site give more details on COGNET, BATON, and their links to specific portions of the research literature.

TRAINING:
A significant problem for training individuals and teams is the expense associated with the time and resources required (e.g., support personnel, team members, instructors). iGEN™ cognitive agents can be used in different ways to provide a better training environment.

Synthetic Teammates: iGEN™ can be used to build agents that synthetically represent team members during team training. These synthetic teammates are capable of standing in for their human counterparts to support individual or partial-team training on teamwork skills.

Synthetic Instructors: Synthetic instructors use domain and task knowledge to provide context-based observations and assessments of trainee behavior. They can be designed to provide assessments that may be diagnostic at either the behavioral level (e.g., trainee did not perform a required procedure) or at the cognitive level (e.g., trainee did not understand the required procedure). These assessments may be presented to the trainee during the training exercise and/or after the exercise (i.e., after action review).

PERFORMANCE SUPPORT:
iGEN™ can be used to develop agents that help workers improve their own performance on the job by providing decision support and performance support. These agents act much like a human associate in that they can reduce the workers workload, suggest that the user focus on particular tasks and engage in problem solving dialogue.

Agent-based performance support can:
***** reduce costs by reducing retraining time and time to competency for personnel
* increase safety, by providing safety-critical information when it is needed, and by ensuring compliance with procedures
* reduce liability, by automating accurate record-keeping

iGEN performance support agent capabilities include:
***** Managing work flow - reminding the user of work tasks that need to be done now and how they should be prioritized, and helping them keep track of things that might otherwise "fall through the cracks"
***** Structuring work and decision processes - tailoring the general work flow to the current instance at hand, and guiding the user through the tailored process if need be
***** Keeping the "big picture" - helping the user keep aware of the larger situation and being proactive in anticipating problems before they occur.

SIMULATION
Simulating complex systems before they are built allows detailed non-destructive and low-cost analysis and testing. Often, though, the critical component of simulation is the human element. The most important questions can't be answered through simulation without a reasonable model of how the human operator, human team or human organization will behave. iGEN™ human performance models (HPM) provide the modeling and simulation community with a powerful new tool to represent the human element in advanced simulation.

iGEN™ HPM agents can be built to represent the knowledge-based work and decision processes of individuals (such as workstation operators), teams (such as command teams or control room teams), or even whole organizations (such as command and control nodes, enemy or competition organizations). iGEN™ HPM agents incorporate the knowledge and work processes of the human element being simulated. The powerful iGEN™ cognitive agent architecture applies these to simulate the desired range of behavior, including individual variability, errors, population variability, and some forms of learning. The result is dynamic and adaptive behavioral simulations that are robust and scenario-independent.

Equipment/Software Required:
Windows 95, 98, 2000, NT, XP. Recommend at least 64Mb RAM. For compilation of the communication shell (API), use Microsoft Visual C++ 6.0, service pack 3 or greater.

Standalone Agent Requirements: Windows (95, 98, 2000, NT, XP), Unix (Linux (RedHat 6.1+), IRIX (6.5), Solaris (2.6))

Input/Output Processing:
Workbench-based development approach—a collection of high level agent-building tools that facilitate engineering of intelligent applications
* Visual programming interface—a graphical way of defining program logic and knowledge, for easier use by programmers and non-programmers, alike
* Well-structured Application Program Interface—permitting integration of iGEN cognitive agents with and within existing applications using standard languages (e.g., C/C++, Java) and protocols (COM, CORBA, HLA)

Documentation:
Users' Reference Guide. CEL and C++ Shell Reference Guide.

Extensive reports and references are available on the iGEN web site.

Stage of Development:
Version 2.0

Comments:

iGEN is a Cognitive Agent Software Toolkit that allows you to develop your own applications in-house. CHI Software can provide training, consulting and application development services.

How To Acquire:
Web site or Point of Contact listed above.

Title: Improved Performance Research Integration (IMPRINT) Tool

Overall Category: Tool
Updated: August 2004

Owner/Sponsor Organization: US Army Research Laboratory (ARL-HRED)
http://www.arl.army.mil/

Point of Contact Information:

Mr. John Lockett
410-278-5875 DSN: 298-5875 FAX: 410-278-5032
jlockett@arl.army.mil

Product Specific Web Site:
https://www.arl.army.mil/ARL-Directorates/HRED/imb/imprint/Imprint7.htm

General Overview:
IMPRINT is a Human Systems Integration (HSI) and Manpower versus Hardware Integration (MANPRINT) tool developed by the U.S. Army Research Laboratory, Human Research & Engineering Directorate. It is a dynamic, stochastic discrete event network modeling tool designed to help assess the interaction of soldier and system performance throughout the system lifecycle--from concept and design through field testing and system upgrades. IMPRINT may be used in stand alone mode or models may be linked through external communication call protocols such as HLA.

As a system design and acquisition tool, IMPRINT can be used to help set realistic system requirements; to identify soldier-driven constraints on system design, and to evaluate the capability of available manpower and personnel to effectively operate and maintain a system under environmental stressors. IMPRINT is also used to target soldier performance concerns in system acquisition, to estimate soldier-centered requirements early, and to make those estimates count in the decision making process.

As a research tool, IMPRINT incorporates task analysis, workload modeling, performance shaping and degradation functions and stressors, and embedded personnel characteristics data.

IMPRINT uses Micro Saint, an embedded discrete event task network modeling language, as its engine. Task-level information is used to construct networks representing the flow and the performance time and accuracy for operational and maintenance missions. IMPRINT is used to model both crew and individual soldier performance. For some analyses, workload profiles are generated so that crew-workload distribution and soldier-system task allocation can be examined. In other cases, maintainer workload is assessed along with the resulting system availability. Also, using embedded algorithms, IMPRINT models the effects of personnel characteristics, training frequency, and environmental stressors on the overall system performance. Manpower requirements estimates can be generated for a single system, a unit, or Army-wide. IMPRINT outputs can be used as the basis for estimating manpower lifecycle costs.

The various analysis capabilities in IMPRINT provide output appropriate for use by the system design and acquisition communities, MANPRINT practitioners, researchers, managers, and decision and policy makers.

Equipment/Software Required:
The minimum requirements are Pentium running under Windows 95/98/NT/2000, 128MB RAM minimum of 75MB disc space, and a VGA monitor. No additional software is required. However, Microsoft Excel is desired for enhanced reporting and graphing.

Input/Output/Processing:

Input requirements vary according to type of analysis performed. Examples of input include mission-function-task breakdown, task time and accuracy, failure consequence, system-subsystem-component breakdown, mean operational units between failure (MOUBF), and level of environmental stressors (e.g., heat, cold, noise, etc.).

Processing consists of dynamic, stochastic, discrete event modeling; personnel projection or "flow" model.

A broad spectrum of both detailed and summary reports are available, as well as detailed printouts. Graphics and workload levels, and task networks, as well as timeline of task performance and diagnostic reports of subfunction and task failures, are available.

An Analysis Guide available at the IMPRINT webpage includes input and output for typical analysis questions.

Documentation:
Online help is available. A users manual, analysis guide, reports list, and training workshop slides are all available on the IMPRINT website.

Alternative/Comparable Approaches:
Related approaches: Micro Saint, Integrated Performance Modeling Environment (IPME), Man-Machine Integration Design and Analysis Systems (MIDAS)**.** IMPRINT replaces HARDMAN III. WinCrew functionality is included in IMPRINT as “advanced workload”. Software developed for the Air Force Research Laboratory Combat Automation Requirements Testbed (CART) program is included in IMPRINT as “Goal Orientation” modeling enabling adaptive human behavior in a changing environment. The Air Force CART contact is: Greg Barbato, AFRL-HECI, 937-255-6670, gregory.barbato@wpafb.af.mil

Stage of Development:
The current version of IMPRINT is version 7. Version 8 will be split into IMPRINT Standard and IMPRINT Pro.

The changes to version 7 were the conversion of database and coding from 16 bit Borland C to 32 bit Microsoft® C; which increased the stability and supportability of the product while decreasing run times. Other changes were the increased assumed resolution from VGA to SVGA so that users can see more of the input screens at a time. This is especially useful when filling in the large matrices of multiple resource theory data. A user interface improvement was the addition of a hierarchical tree view showing all the data elements in an analysis. The personnel databases and projection algorithms were updated using information supplied by the Defense Manpower Data Center (DMDC). The capability to interact efficiently with other simulations running at the same time was enhanced by adding the capability to dynamically subscribe and unsubscribe entities to a server. Version 7 also includes a module for building user defined performance moderators. This allows the user to create algorithms for varying task performance time or accuracy by task type based on conditions besides the default set (heat, cold, noise, fatigue, or protective clothing) provided in IMPRINT.

Date Current Version Released:
February 2004

Validation:
HARDMAN III, the predecessor to IMPRINT was subjected to a verification, validation and accreditation (VV&A) process, Phase I of which was completed in January, 1995. Each version of IMPRINT undergoes verification testing at ARL, HRED. Much of the algorithms and structure underlying IMPRINT is unchanged from HARDMAN III so much of that validation is applicable. Validation of changes made in IMPRINT, areas not validated in HARDMAN III, and new functionality is ongoing.

Comments:
IMPRINT has limited distribution, available to US government agencies and private US industry and US universities with a US government contract.

How To Acquire:
Follow instructions on IMPRINT website.

Title: Information Processing/Perceptual Control Theory (IP/PCT) Model

Overall Category: Tool
Update: March 2005

Owner/Sponsor Organization: Defence Research and Development Canada
http://www.toronto.drdc-rddc.gc.ca/

Point of Contact Information:

Mr. Keith Hendy
416-635-2074 DSN: 827-2074 FAX: 416-635-2013
keith.hendy@drdc-rddc.gc.ca

General Overview:

The IP/PCT model provides an integrating framework for understanding the origins of operator workload and the relationship of workload to concepts such as cognitive compatibility and situation awareness. It provides insight into individual and team decision making. The IP/PCT model can be given quantitative form, as is demonstrated in the Integrated Performance Modeling Environment (IPME) software for task network analysis (see entry for IPME, DDSM0162).

As a framework for understanding operator information processing limitations and their impact on perceptions of workload, error production, and performance the IP/PCT model can be encoded for embedding software for task network simulation. It is not a trivial activity to code the full model into standard software, such as Micro Saint; however, the IP/PCT model has been incorporated into a commercially available software environment (IPME from Micro Analysis and Design -- as above, see entry for IPME).

The IP/PCT model has been used as a framework for designing a new approach to Crew Resource Management (CRM) training. From the IP/PCT model, a behaviorally anchored rating scale has been devised to assess resource management performance in terms of the timeliness and appropriateness of decisions and the overall management of time, knowledge, and attention. The IP/PCT model can be used in performance prediction tools that fulfill the activities recommended in a MIL-HDBK-46855 front-end human engineering analysis and has anchored the development of a tool (SERA) for accident analysis and investigation.

Analyst Qualifications: 1-5 yrs. HFE experience; familiarity with the literature on operator workload.

Input/Output/Processing:

As a descriptive model, no quantitative data are required. When embedded in a program for task network analysis, certain data describing the tasks and task sequences are required. This is described in the SOLE/IPME entry (see DDSM0162).

Through a simple application of information processing theory, the IP model reduces all workload effects to their action on the amount of information to be processed, or the time available for processing. Various diffusely acting psychological and physiological stressors are claimed to affect the rate at which information can be processed (in bits per second), and so affect decision times. For most applications of the IP model, it is only necessary to accept the underlying concepts of the model. It is not necessary to actually measure the amount of information being processed for the model to be useful. The PCT models are complementary. The IP model sits within the PCT framework at all points where information is actively processed.

The IP/PCT model integrates most factors that one associates with operator workload and situation awareness into their effect on time, knowledge, and attention. These three factors are inextricably bound up so that they always trade-off, one against another. The IP/PCT provides a framework for understanding how human information processing limitations impact on performance. When used in the qualitative sense, this knowledge is the output.

When used as a predictive model, say, in a task network simulation, the IP model provides a metric of operator workload and performance.

Documentation:
Hendy, K.C. and Farrell, P.S. (1997), "Implementing a Model of Human Information Processing in a Task Network Simulation Environment" (DCIEM 97-R-71), North York, Ontario, Canada: Defence and Civil Institute of Environmental Medicine.

Hendy, K.C., Liao, J. and Milgram, P. (1997), "Combining Time and Intensity Effects in Assessing Operator Information Processing Load", Human Factors, 39(1), 30-47.

Hendy, K.C., Liao, J., and Milgram, P. (1994). Combining time and intensity effects in assessing operator information processing load. (Submitted to Human Factors).

Alternative/Comparable Approaches:
Multiple Resource Theory, W/INDEX, Wingert's functional interface method. The IP/PCT model incorporates aspects from many models, and, therefore, is both comparable to and different from these other approaches at the same time.

Validation:
For information regarding the following validation studies, please contact the POC: East, K.P., Hendy, K.C. and Matthews, M. (1996), "Validation of an Information Processing-Based Model for Workload and Performance Prediction", in Proceedings of the Human Factors Society of Canada, 29th Annual Conference, Mississauga, Ontario, Canada: Human Factors Association of Canada, 155-160.

Hendy, Liao and Milgram (1997) (see DOCUMENTATION, above).

How To Acquire:
Point of contact listed above.

Title: INJURY 7.0

Overall Category: Tool
Update: July 2004

Owner/Sponsor Organization: US Army Medical Research and Materiel Command,
Military Operational Medicine Research Program
http://mrmc-www.army.mil/

Point of Contact Information:

LTC (P) Carl Hover, Deputy Research Area Director, MOMRP
301-619-7301 DSN: 343-7301 FAX: 301-619-6681
carl.hover@det.amedd.army.mil

General Overview:
INJURY 7.0 is a blast overpressure predictive injury model that will be used to predict combat survivability of soldiers, give guidance for firing restrictions during training, and to aid in the development and procurement of safer weapon systems. It will contain a Health Hazard Assessment Methodology that allows a precise estimate of the hazard in a given blast environment (prediction of probability of injury at any confidence level) and a basis to evaluate model predictions in prospective tests.

Equipment/Software Required:
Personal computer running MS Windows 98, 2000, XP

Input/Output/Processing:
Input: blast overpressure pressure-time histories taken with Blast Test Device (BTD).

Output: numerical integration of biodynamic model equations.

Processing: calculates work done on lung tissue to predict probability of none, trace, slight, moderate and severe lung injury.

Documentation:
User manual and on-line help.

Alternative/Comparable Approaches:
Military Standard 1474D

Stage of Development:
Under U.S. Army Medical Research and Materiel Command (MRMC) review. INJURY 7.0 (current version) - released to blast community on an as-needed basis after receiving MRMC review.

Date Current Version Released:
April, 2003 (estimated)

Validation:
Retrospectively validated against animal tests conducted at the Blast Overpressure Test Site, Albuquerque, NM. Peer reviewed in October, 2000 by a panel of independent scientists and experts in the field of blast injury and biomechanical modeling of injury. Published in the peer-reviewed Journal of Biomechanics (Stuhmiller, J. H., Ho, K.H.-H., Vander Vorst, M. J., Dodd, K. T., Fitzpatrick, T., and Mayorga, M. (1996) "A Model of Blast Overpressure Injury to the Lung," *J. of Biomechanics*, Vol. 29, No. 2, pp. 227-234).

Comments:

Adopted by the U.S. Army Surgeon General for use in the Army Health Hazard Assessment Program administered by the U.S. Army Center for Health Promotion and Preventive Medicine, Aberdeen Proving Ground, MD.

How To Acquire:
Point of contact listed above.

Title: Integrated Performance Modeling Environment (IPME)

Overall Category: Tool
Updated: August 2004

Owner/Sponsor Organization: Micro Analysis and Design, Inc.
http://www.maad.com/

Point of Contact Information:

Ms. Wendy Bloechle
303-442-6947 FAX: 303-442-8274
wbloechle@maad.com

Product Specific Web Site:
http://www.maad.com/ipme/

General Overview:
The Integrated Performance Modeling Environment (IPME) is an integrated environment of models intended to help the human factors practitioner analyze human-system performance. IPME provides:

- a more realistic representation of humans in complex environments
- interoperability with other model components and external simulations
- enhanced usability through a user-friendly graphical user interface

These capabilities help the practicing professional solve their problems by providing answers to questions involving human performance.

The development of IPME has been a collaborative development effort among the United Kingdom's Qinetiq, formerly Defence Evaluation Research Agency's Centre for Human Sciences (DERA CHS), Canada's DRDC-Toronto, formerly Defence and Civil Institute for Environmental Medicine (DCIEM) and Micro Analysis and Design Inc. (MAAD).

IPME uses a process-oriented modeling approach and builds upon a Subject Matter Expert's (SME's) accounting of how operator activities are organized or may be organized to meet operational objectives. Operator responsibilities and goals can be recorded at a high level of abstraction (such as "Prepare for Mission") that can be decomposed into a hierarchy of functional blocks (such as "Prepare Met Brief") until the analyst has reached a level of granularity (such as "Read Current Weather Map") appropriate to study a given problem.

The key IPME features are:

Environmental Model. The environment model describes external factors such as physical, crew, mission, and threat factors. These include environmental variables such as temperature, humidity, time of day, etc.

Crew Model. The crew model defines individual operator roles, and includes operator characteristics such as non-physical traits (fitness, training), states that change during simulation (boredom, hunger), and physical properties including anthropometry (weight, height). Because states can be updated during a simulation run, each operator defined in a crew model can have unique characteristics.

Performance Shaping Functions. A performance shaping model is a collection of user-defined functions called performance shaping functions (PSFs) that modify the time it takes to complete a task, or the probability of task failure. The PSFs are linked to individual tasks through a task taxonomy, allowing one PSF function to be dynamically applied to any similar task in a model. Since PSFs can use operator states as expression variables,

models can discriminate performance results as a function of operator characteristics. Therefore, simulations can have two operators performing the same task type with different, and therefore more realistic, task time and probability of failure outcomes.

Prediction of Operator Performance (POP) Scheduler and Workload Measurement. POP, developed by the Defence Evaluation Research Agency (DERA) 1992-1995, predicts performance degradation from interference between concurrent tasks. Input (visual or auditory), central (mental operations), and output demands (manual or vocal) are considered for each task.

Information Processing (IP) Scheduler. IP/PCT was developed by Keith Hendy of DRDC-Toronto. This workload methodology posits that all factors that impact human cognitive workload can be reduced to their effects on the amount of information to be processed (an operator's cognitive limits), and the amount of time available before the task must be completed (an operator's time pressure). According to IP/PCT, human operators change their processing strategy to reduce the amount of information to be processed, or increase the time available.

McCracken and Aldrich VACP and Workload Index. VACP and W/Index measure the resource demand imposed upon an operator. The VACP algorithm measures the task loading for an operator within visual, auditory, cognitive, and psychomotor channels (McCracken 1984, Bierbaum 1987). The W/Index algorithm (Sarno 1992) measures the resource demand imposed upon an operator within six resource channels, and supports interference between channels.

Measurement Suite. Allows the user to set up experimental runs using independent variables that can be set to different initial values for each experimental run. Multiple experimental runs can be defined and multiple simulation runs (or iterations) can be specified for each experimental condition. Blocked experimental designs are supported.

Micro Saint Human Operator Simulator (MS HOS) Engine. IPME is based on the Micro Saint simulation engine with the Human Operator Simulator extensions. It offers the following features:

A discrete event Monte Carlo simulation engine with an easy to use Graphic Interface (GUI). The GUI provides a drawing space where network diagrams defining man and machine tasks are constructed using visual components. Network element sequence is defined by connecting model components with mouse point, click, and drag operations. Micro Saint supports several types of human decision models as queues to allow the representation of the most complex of operations.

The HOS extensions provide a mechanism to define a work space associated task network. This work space can contain work zones or work surfaces, operators and positional markers. Work zones can also contain work surfaces, operators and positional markers. Work surfaces can contain work controls with which the operator would interact. These controls can include things like keyboards, mice, dials, knobs, etc.

Built-in micro models of human behavior can be related to the operator and the control and used to dynamically modify the time to perform a task based on operator position. Micro models are functions that represent basic human actions. MS HOS contains both static micro models (not relying on operator position) and dynamic micro models (relying on operator position). Dynamic micro models such as reaching rate, relate an operator in a work space or zone and a control on a work surface. Times are calculated and used during the simulation based on operator to control distance and the size of the control.

Simplifies modeling task failures. Task failure is represented as a "Probability of Failure" defining various actions that can result from a task failure such as no effect, repeating the failed task, having another task's time or failure probability modified, or even aborting the simulation as a result of a catastrophic failure.

Advanced modeling features are included. The IPME engine allows hierarchical representation of tasks, a function library allowing user defined functions, and an event catalog to allow dynamic events to trigger based

on time or a condition within the simulation, and custom data collection. In sum, a full-featured discrete event simulation environment is built-in.

Communications Protocols. The external model allows IPME to communicate with other existing models or applications. There are two supported communications protocols: a TCP/IP sockets interface and High Level Architecture (HLA). The HLA implementation in IPME uses the Defense Modeling and Simulation Office (DMSO) Run-Time Infrastructure (RTI) version 1.3NG version 3.2. IPME does not yet define a Federation Object Model (FOM), as is typically required by federations. It is anticipated that with further interest and participation in using IPME as a federate in a federation, at that time a FOM will be developed.

Master Database. The master database facilitates collaborative modeling efforts by providing modelers a place to store reusable model components. Environment models, Performance Shaping Functions, Operators, Micro Models, and task network fragments may be stored in the Master Database where they are made available to other modelers. This promotes code reusability, while write-protecting the saved model components.

HAWK – Human Analysis Work Kit
HAWK ties the human factors analysis process and tools together, and makes data transfer to IPME much simpler. HAWK is intended for use at the Subject Matter Expert's or client's workplace, usually without direct access to IPME. HAWK is a stand-alone Java application that runs on personal computers and uses a MySQL database that is structured the same as IPME's MySQL database. Data collected in HAWK can be transferred to IPME at any point using a database connection. In addition, crew and task network models can be loaded from a remote IPME database for further modification in HAWK. Some of the analysis tools available in HAWK are:

- Critical Task Analysis
- Function Allocation
- Hierarchical Goal Analysis
- Execution Viewer

Equipment/Software Required:
Linux RedHat 7.2 or 8.0. RedHat 9.0 is not currently supported.
Minimum of 256MB of RAM
Minimum 750 Mhz. processor

Input/Output/Processing:
Crew composition (description of operators), tasks of the operators need to perform, task timing information, task probability of error if available, stressors on the operators, description of the environment in which the operator resides.

Absolute minimum is a list of tasks to be performed with timing information.

IPME allows custom snapshots (recording the value of the variable to a file) of any simulation state variable. In addition, McCracken and Aldrich VACP and W/Index values can be displayed during run-time and saved to an output file which can be later displayed using an associated Java tool, Human Analysis Work Kit (HAWK). A trace file can be saved showing complete information on when tasks begin and end. There are two specialized schedulers within the IPME and each will create an audit file that can be used to perform analysis of expected human performance.

Documentation:
IPME user guide, IPME Task Network user guide, and HAWK user guide are available. There is also a wealth of information available on the IPME User's Group web site.

Alternative/Comparable Approaches:
This is unique software that is at the cutting edge of HF technology.

Stage of Development:

Version 3.0

Date Current Version Released:
7 May 2004

Validation:
The micro-models have been validated.

Comments:
Training is available onsite or in Boulder, CO. See Website at www.maad.com for more information.

How To Acquire:
Point of Contact listed above.

Title: Jack(r) Human Simulation Software

Overall Category: Tool
Update: July 2004

Owner/Sponsor Organization: UGS

Point of Contact Information:

Pete Tiernan
800-498-5351 FAX: 314-264-8913
pete.tiernan@ugs.com

Product Specific Web Site:
http://www.ugs.com/products/efactory/jack/

General Overview:
Jack is a human-centric visual simulation software package that enables users to create virtual environments by modeling them natively or importing CAD data, populate their environment with kinematically accurate human figures, assign tasks to these virtual humans, and obtain valuable information about their behavior. Jack provides the industry's highest-fidelity human model, with accurate joint limits, a fully defined spine, flexible anthropometric scaling, and such advanced behaviors as head/eye tracking, natural walking, balance control, seeing, reaching, grasping, bending, and lifting.

Organizations use Jack to improve the ergonomics and human factors of product designs, manufacturing processes, and maintenance procedures.

By using simulation to evaluate the needs of humans in the earliest phases of product design, organizations ensure that products are safer, more useful, and more comfortable for the targeted user population. Just as importantly, UGS's software enables users to solve human-related design issues earlier, get closer to their final design faster, and thereby minimize the number of physical prototypes they have to test. This translates into accelerated time to market and lower development costs.

Organizations are realizing similar benefits from UGS software solutions in manufacturing and maintenance. By factoring in the needs of humans early in the design of manufacturing and maintenance tasks, organizations are bringing factories online faster, optimizing productivity, improving worker safety, and minimizing the time and cost required to maintain products.

Output from Jack is used in various applications related to human-centered design, human-intensive virtual manufacturing, maintenance task planning, and simulation-based training:

Human-centered design applications
- Fit and comfort
- Visibility
- Strength requirements
- Multi-person activity
- Reach, grasp, and manipulation
- Foot pedal operation

Manufacturing task planning applications
- Workcell layout
- Workflow simulation
- Manual assembly

- Material handling
- Assistive device usage

Maintenance task planning applications
- Accessibility and space claims
- Part removal and replacement
- Manual task studies
- Visibility
- Strength capability

Injury risk assessment

Simulation-based training applications
- Training videos
- Multimedia presentations
- VR training programs

Equipment/Software Required:
Jack is a stand-alone software package that runs on any of three platforms:

	Windows	SGI	HP
OS Version	2000/XP	IRIX-6.5.x	HPUX 11.x or higher
Processor	266MHz or higher	O2 R1000 or higher	C180 or higher
Memory	64 MB or higher	64 MB or higher	64 Mb or higher
Required Disk Space	130 Mb	160 Mb	1709 Mb
Screen Resolution	1024 x 768 or higher	1024 x 768 or higher	1024 x 768 or higher

Input/Output/Processing:
Create 3D objects within Jack, or import 3D data based on all popular formats (JT, IGES, VRML, STL, DXF, etc.), translated into Jack.

Jack provides a data reduction functionality to reduce the size of large 3D databases to enable fast frame-rate (real-time) simulation.

Jack is a real-time visual simulation system based on fast inverse kinematics. The human "manikins" created by the software are based on an anthropometry database derived from the ANSUR 88, NHANES III, CPSC Children, and others. Jack digital people have 69 segments, including a realistic 17-segment spine and 16-segment hands, and they obey joint and strength limits derived from NASA studies.

The procedure for using Jack is as follows:
- Import CAD models or build virtual environments from scratch.
- Insert kinematically correct virtual humans and size using reliable anthropometric data.
- Assign and animate complex tasks, Assign and animate complex tasks such as walking, carrying, reaching, grasping and lifting.
- Utilize sophisticated human performance models to analyze the ergonomics of the task sequences.
- Resize people and objects, and then rerun the same simulation for “what-if” scenarios.
- Author complex human motions or perform immersive studies using Jack’s support of a wide variety of real-time optical and magnetic Motion Capture hardware.
- Script complex tasks and extend Jack’s functionality using powerful JackSript and Tcl/tk scripting languages.

Output
- 3D images and simulations (in popular image and movie formats)
- Low back spinal force analysis reports

- NIOSH lifting studies
- Metabolic energy expenditure reports
- Comfort assessments
- Static strength predictions
- Reach envelopes
- Safety zones
- Seating accommodation reports
- Visibility information

Analyst qualifications: Bachelor's degree and/or 3D software user experience helpful; three-day training course required.

Documentation:
Jack User's Guide, Jack Tutorial and on-line help.

Stage of Development:
Jack has been commercially developed since 1996. Releases are on approximately 6 month intervals.

Validation:
"Efforts in Preparation of Jack Validation", Francisco Azuola, et al., published in Dec., 1997, by the Army Research Laboratory at Aberdeen Proving Ground, MD, Report #ARL-CR-418. To obtain copies, contact the Defense Technical Information Center (DTIC).

Comments:
Other Relevant UGS Products:

The Jack functionality is also available in the UGS NX CAD environment and the UGS Teamcenter Visualization (Vis Products) environment.

* Jack
Full featured stand alone package including animation, motion capture, ergonomic performance models, advanced anthropometry.

* Teamcenter Visualization Jack
Integration of the Jack functionality in Vis Products for first pass ergonomics evaluation of fit, reach and vision within a CAD neutral geometry review tool. Vis Products is designed for rendering of very large product assemblies and collaborative review.

* NX Jack
Jack functionality in the NX CAD environment. Utilize the biofidelic Jack manikins directly within the NX CAD tool.

UGS teaches introductory and advanced training courses for Jack at its Livonia, Michigan facility. Update courses are also available for new versions of the software.

How To Acquire:
Sales details for all Jack products can be obtained from the Point of Contact listed above or through the www.ugs.com website.

Title: Job Assessment Software System (JASS)

Overall Category: Tool
Update: July 2005

Owner/Sponsor Organization: Army Research Laboratory/Human Engineering and Research Directorate
http://www.arl.army.mil/ARL-Directorates/HRED/hred.html

Point of Contact Information:

NASA Johnson Space Center (Lockheed Martin)
Mr. Barry Tillman
281-483-7131 FAX: 281-483-1847
barry.tillman1@jsc.nasa.gov

General Overview:
JASS is a computer based survey tool used to identify and rate the level of skills and abilities necessary to perform jobs and job duties. Survey participants provide a rating value for a taxonomy of 50 generic cognitive skills and perceptual-motor abilities. The survey is based on the research of Dr. Edwin Fleishman.

This tool is appropriate for, but not limited to, addressing issues in the MANPRINT domain. JASS is useful in determining the skills and abilities required to operate and maintain a current system and comparing those required from a proposed new system acquisition. The skills and abilities of the proposed new system can also be compared to the available population of operators and maintainers. Information on excessive or unique skill demands can be used to influence system design early in the acquisition cycle.

Training and personnel system managers can also use JASS data to analyze and compare the skills and abilities of a particular job with the skills and abilities of the available job holders or to match the skills and abilities of new recruits with Military Occupational Specialties (jobs).

Additional JASS tools allow data analysts to predict training retention intervals, prepare human factors design guidelines for reduction of high skill demands, and to evaluate the compatibility of duties within a specific job.

Equipment/Software Required:
Personal computer running Microsoft Windows operating system, hard drive, CD-ROM drive and 3 1/2 inch drive, mouse, and monitor.

Input/Output/Processing:
JASS survey administrators must enter a brief description of the job assignments and duties required to perform the job.

Survey respondents must be familiar with the job and duties under examination. This familiarity can be achieved through a simulated system, prototype system, or existing, full-up system. The JASS survey respondents answer "yes" and "no" questions to identify the need for specific skills. They then provide scale scores to rate the level of each skill that is required to perform each job duty. To help, JASS shows example ratings for common tasks.

The scale scores are written to a Microsoft Access© database by skill. The database may contain survey data from multiple respondents. An output report displays the mean and standard deviation of scores for each skill from all respondents in the database as well as the raw survey data. This information can be imported into a spreadsheet or other data manipulation package.

Documentation:
All documentation is embedded on line.

Stage of Development:
There are currently two components of JASS, one for the experimenter who enters the job information and then analyzes the survey data and one for the survey respondents. The Experimenter component is version 2.3. The Data Collection component is version 2.2.

Date Current Version Released:
Both JASS components were completed on 14 April 1999

How To Acquire:
Point of Contact listed above.

Title: Knowledge Base Development Tool (KBDT)

Overall Category: Tool
Update: February 2005

Owner/Sponsor Organization: Prospective Computer Analysts, Inc.
http://www.pcaonline.net/

Point of Contact Information:

Mr. Greg Winter
516-742-9100 x107
gwinter@pcaonline.net

General Overview:

The Knowledge Base Development Tool (KBDT) is a Windows-based, multimedia tool which assists in the capture and maintenance of any and all data types, including video, audio, graphics, pictures, bitmaps, and text. Information is captured, archived to a central repository or compact disc (CD), and is available to users via Windows-capable, mouse-driven, user-friendly programs. The KBDT can be used to capture expert knowledge, loss of experienced personnel, digitized hardcopy, and as a training tool. At any time, data may be accessed from remote sites via networking and/or modem, or be written to CD for distribution to offsite or remote facilities and activities.

The KBDT is a valuable, easy-to-use tool for capturing, accumulating, storing, and distributing information, doing so in a cost-effective and timely manner. Training personnel, costs, and scheduling are all exercised in a more effective manner when utilizing the KBDT. The KBDT can be used to archive policies and procedures, technical documentation, personnel records, and a multitude of other data and databases. Any information adhering to open database connectivity may be integrated. Maintenance and/or updates may be easily performed on a regular schedule, or as the changes occur. Access to the information is enhanced by simple mouse pointing/clicking and also by using hypertext (launch information by clicking an area of interest). This tool can be utilized in any environment, be it DoD or commercial arenas.

As a reference library, or as an interactive repository and/or CD training tool, the KBDT can assist in making operations more efficient and effective.

Output may be utilized for training, user reference and/or review, hardware review in the field, and as comment references for updates, changes, and enhancements to the knowledge.

Equipment/Software Required:

CD review/interaction: Pentium III 350 MHz or higher CPU, 128 MB RAM, CD-ROM, sound card/speakers, Microsoft Windows 98, 2000, NT, or XP, 5 MB hard disc space.

Total development production system -- add: 150 MB hard disc space, Microsoft Visual Basic, video capture card and production software, CD writer and software.

Input/Output/Processing:

The data contained in the KBDT is generated and/or integrated initially with PCA and prospective users' joint input and development. Once the baseline knowledge base has been generated, CDs may be written and distributed. If the user wishes to update the knowledge base and consequential CDs, the user will provide the information to PCA for update, or be trained to become familiar with the KBDT tp perform an update independently.

CDs can be generated for user interaction and distribution. Additionally, online and/or hardcopy reports may be generated reflecting specific areas of interest contained within the knowledge base. If so desired, ad hoc (specialized) reports, or listings of selected topics, may be generated.

Documentation:
KBDT Installation and Users Guide.

Alternative/Comparable Approaches:
Other vendors developing multimedia, training, or knowledge capture tools.

Stage of Development:
Copyright 1994-1996; tools, procedures, and expertise available; task generation upon specific identification of effort.

Comments:
"A user-friendly, cost-effective, knowledge base and training tool."

How To Acquire:
Point of Contact listed above.

Title: LOCATE

Overall Category: Tool
Update: April 1998

Owner/Sponsor Organization: Defence Research and Development Canada
http://www.toronto.drdc-rddc.gc.ca/

Point of Contact Information:
Mr. Keith Hendy
416-635-2074 DSN: 827-2074 FAX: 416-635-2013
keith.hendy@drdc-rddc.gc.ca

General Overview:
LOCATE is a computer-aided tool for analyzing the strength of communication, in the visual, auditory, tactile, and movement domains, in multi-operator- machine workspace layout problems. LOCATE uses a form of link analysis that is sensitive to both the length and angular properties of the link. Transformation functions approximate the visual, auditory, and movement properties of the humans and machines in the workspace. The link strength components for each human-human, human-machine, and machine-machine interaction are rolled up into a single cost function. Matrices of component costs are also presented for the purposes of diagnosis.

LOCATE is currently restricted to the two-dimensional layout problem, although conceptually it could be extended to three dimensions at some time in the future. LOCATE was designed to interface with mathematical optimization techniques that can operate on the positions and orientations of individual workstation elements to produce a minimum cost layout. LOCATE is not currently linked with an optimization package.

LOCATE was developed using Platform Independent Graphic User Interface (PIGUI) software. This software is linked to an expert system shell. LOCATE has a proof-of-concept adaptive help system that monitors keystrokes and menu use, and provides tailored help to the user. LOCATE is also linked to a browser for access to data sources on the Internet.

To assist in the layout of multi-operator-machine workspaces, such as ship's bridges, operations rooms, command and control centers, material-handling environments, and workshop floors. LOCATE was built specifically to be applicable to the design of workspaces that were within the near-to-far range of human sensory capabilities. In certain circumstances, LOCATE may have application to panel design or to single-operator workstations.

Arranging workstations within a two-dimensional workspace, so that good communication is possible by visual, audible and tactile means, and movement patterns are facilitated.

Analyst qualifications: 2-3 yrs. HFE experience; 4 hrs. training on the tool.

No formal training is in place; LOCATE comes with a tutorial.

Equipment/Software Required:
LOCATE is easily portable to a variety of operating systems running on some 40 hardware platforms, but requires the purchase of a development system for the target platform, and approximately two to four weeks to port the software. Currently tested on Mac OS 7.1 and higher; Windows 95; minimum 68030 (MAC) or 486 (PC) -- preferred, Power Mac, Pentium 166+-compatible; minimum 8 MB RAM for the application (preferred, 16 MB); 8 MB hard drive; Super VGA (PC) video card; Open Transport and OS 7.6.1 or higher for access to Internet Help Files (MAC) (Internet access not yet tested on PC).

Input/Output/Processing:

LOCATE requires no more or no less data than an equivalent conventional layout analysis. The type of data required is dependent on the specific application (e.g., the nature and function of the workspace). Typically, one would need to know the physical characteristics of the individual workstation elements, the presence of fixed obstructions in the floor plan, the characteristics of audio and visual sources of information within the workspace, the environmental parameters that apply to the workspace, a basic function or task analysis, the priority of all communication links (this could be based on frequency of use, for example), and the relative priority of each communication domain. In essence, the information required is the information one has always had to consider in doing a comprehensive human engineering analysis of a workspace.

Use standard human engineering references, experiments if required, or direct observation. Video and audio capture is often appropriate.

Engineering drawings, human engineering standards, design handbooks and guides, movement analyses, display specifications (font size, acceptable viewing angles, etc.), environmental analyses (noise, vibration, lighting levels, dust, smoke, haze, etc.), and similar environments.

Generally, no specific data manipulation is called for. LOCATE makes extensive use of default values to reduce the amount of time spent before preliminary cost functions can be run.

Link lengths and link angles between individual workstations are passed through various transformation functions that approximate the visual, auditory, and reaching capabilities of the human operators to produce an estimate of the strength or quality of a given communication link. Similar transformation functions specify the characteristics (readability, audibility, reachability, etc.) of the displays and controls within the workspace. Separate link strengths are calculated for each workstation as both a source of information and as a receiver of information. Link strengths are attenuated by obstructions to vision, audition, reaching, and movement in the workspace. Individual link strengths are converted into a cost (1-strength), weighted by their priority both within and across domains, and additively combined into an overall cost function. The cost function is doubly differentiable and, so, compatible with standard optimization procedures. Optimization is not trivial. The cost function is of high dimensionality, is non-linear, and subject to non-linear constraints. The cost function is not generally representable in an analytic form, and so must be numerically differentiated.

The output of LOCATE is a single value of the cost associated with a particular configuration, as well as the incremental costs associated with each pairwise relationship between workstations, in each communication domain (vision, audition, tactile, movement) and across all communication domains. These data are presented in both textual format (a single number, or a matrix of costs associated with each pairwise combination of workstations) and graphically (the ability to define 4 cost function ranges and color the cost matrix according to membership within each range). The level of detail (overall cost or incremental cost by domain) is user-selectable. Domains can be enabled or disabled for separate analyses (visual, auditory, tactile, or movement domains in any combination). When an optimizer is attached, LOCATE generates configurations that attempt to minimize the overall cost. LOCATE imports and exports DXF files translating the workspace configuration from, and back into, standard drafting packages.

Cost function results can be cut-and-pasted into spreadsheets and word processing packages.

Documentation:

Hendy, K.C. (1984), "'LOCATE': A Program for Computer-Aided Workspace Design" (Minor Thesis, Master of Engineering Science), Clayton, Victoria, Australia: Dept. of Electrical Engineering, Monash University.

Hendy, K.C. (1989), "A Model for Human-Machine-Human Interaction in Workspace Layout Problems", Human Factors, 31(5), 593-610.

Hendy, K.C., Liao, J., and Milgram, P. (1994). “Combining Time and Intensity Effects in Assessing Operator Information Processing Load”. (Submitted to Human Factors).

A tutorial comes with LOCATE.

Alternative/Comparable Approaches:
CORELAP, ALDEP, CRAFT, PLANET, and DISCON are alternative techniques that have been applied to this type of problem. None are strictly comparable, as they vest all the information about the quality of a communication link entirely in the distance between elements.

Stage of Development:
The current version of the software is 1.0. This is the initial release version. The software is quite mature so far as reliability and stability are concerned; however, some minor features and embellishments are missing. LOCATE may be offered for commercial exploitation after further usability evaluation.

Four major developments are planned when funding is available: (1) the addition of an optimizer (this will be a plug-in); (2) the extension of the rule base and capability in the 'intelligent' help facility, including a tutorial for new users; (3) linking LOCATE to various HE guides, standards, handbooks, and other HE resources via the Internet; and (4) providing remote access to LOCATE over the Internet.

The software is available to the Departments of Defense of Australia, Canada, New Zealand, United Kingdom, and the United States and their contractors, under the terms of the TTCP agreement.

Validation:
See Hendy, K.C. (1984, 1989) in “Documentation”, above.

Hendy, K.C., Berger, J., and Wong, C. (1989), "Analysis of DDH280 Bridge Activity Using a Computer-Aided Workspace Layout Program (LOCATE)”, (DCIEM 89-RR-18), North York, Ontario, Canada: Defence and Civil Institute of Environmental Medicine.

Comments:
For details on the development of this software, contact:
Jack L. Edwards, President
AI Management & Development Corp.
206 Keewatin Ave.
Toronto, ON, Canada M4P 1Z8
(416) 488-6068 / FAX (416) 486-6013
jle#interlog.com
http://interlog.com/~jle (for tool information)

How To Acquire:
Point of Contact listed above.

Title: Man-Machine Integration Design and Analysis Systems (MIDAS)

Overall Category: Tool
Update: September 2002

Owner/Sponsor Organization: NASA Ames Research Center,
Human Factors Research and Technology Division
http://human-factors.arc.nasa.gov/

Point of Contact Information:

Mrs. Sandra G. Hart
650-604-6072 FAX: 650-604-3323
shart@mail.arc.nasa.gov

Product Specific Web Site:
http://www-midas.arc.nasa.gov/dev-html/

General Overview:
MIDAS is an integrated suite of software components developed to aid developers, designers, and analysts to apply human factors principles and human performance models to the design of complex human-machine systems. The goal of the program is to develop an engineering environment which contains tools and models to assist design engineers in the conceptual phase of crewstation development, and to anticipate crew training and procedural requirements. The MIDAS test bed serves to aid designers with predictive data on operability, levels of automation, and function allocation issues for human machine systems, and to support further research on human performance models.

MIDAS is intended to be used at the early stages of conceptual design as an environment wherein designers can use computational representations of the crew station and operator, instead of hardware simulators and man-in-the-loop studies, to discover first-order problems and ask "what if" questions regarding the projected operator tasks, equipment and environment for advanced vehicles. MIDAS was originally focused on the design of advanced helicopter crewstations, however, its principled basis and flexible interface have allowed it to be used in other domains (e.g., layout of nuclear power plant control consoles, the design of an emergency response workstation, civil tilt rotor and airline operations). It is currently being extended to NASA Space applications.

Equipment/Software Required:
The MIDAS workstation is hosted on Silicon Graphics 4D Series workstations.

Input/Output/Processing:
MIDAS serves as a framework in which other research findings and models developed at Ames or elsewhere can be instantiated. Inputs vary for each model.

MIDAS contains tools to describe the operating environment, equipment, and procedures of manned systems, with models of human performance behavior used in static and dynamic modes to evaluate aspects of crew station design and operator task performance. Models of visual perception, attention, memory functions, rule-based and algorithmic decision making, task loading, and scheduling behavior are included. These models are encoded in an object- oriented architecture in which the individual models (as well as the system under study) are represented as interdependent agents that communicate with each other. The modular structure and strict communication protocol of this architecture allows MIDAS to support multiple representations of human performance at varied levels of detail. Thus, MIDAS is similar in concept to computational tools, such as finite element analysis and computational fluid dynamics, which are used to improve designs and reduce costs.

The MIDAS output is presented graphically and visually to the research psychologist or design engineer; often as a computer animation of "manned flight". Quantitative timeline and task workload is also available.

Documentation:
Hart, S. G., Dahn, D., Atencio, A. & Dalal, K. M. (2001) Evaluation and Application of MIDAS v2.0. (2001-01-2648) Society of Automotive Engineers.

MIDAS Phase V Detailed Design Document, TN-93-8216-000-3, Dec 1992.

Smith, J. D., Gore, B. F., Dalal, M. K. & Boyle, R. (7/15-18/2002) *Optimizing Biology Research Tasks in Space using Human Performance Modeling and Virtual Reality Simulation Systems here on Earth."* presented at the 32nd International Conference on Environmental Systems, in San Antonio, TX.

Alternative/Comparable Approaches:
AirMIDAS, developed by Dr. Kevin Corker (SJSU) and his colleagues is a spin off of "Core MIDAS". The most visible difference is that AirMIDAS does not use Jack to provide an anthropometric representation. AirMIDAS places more emphasis on the cognitive component of performance and excels at representing multiple participants operating in very complex environments. Recent applications of AirMIDAS have been primarily focused on Air Traffic Management and civil airline operations. It has been recently ported to Linux to extend its flexibility and compatibility with other models.

Stage of Development:
The MIDAS program began in the fall of 1984 and s completed six major phases of development toward a 1995 target date for a full-prototype system. Re-design and re-implementation of MIDAS v1.0 began in 1996. The most significant improvements were included object-oriented design and development methodology, support for multiple operators, the addition of modeled audition, computed situation awareness and the addition of a fully graphic user interface. The Beta release of MIDAS v2.0 was in 1999.

Date Current Version Released:
Fall 2001

Validation:
An independent evaluation of MIDAS was completed by Micro Analysis and Design in 2001.

Comments:
Models instantiated in MIDAS are described separately under names of "Dynamic Anthropometric Modeling (JACK)" and "Modeling of Cockpit Display Visibility".

How To Acquire:
Point of Contact listed above.

Title: ManneQuin Series of Human Modeling Solutions: ManneQuinBE, ManneQuinPRO, ManneQuinELITE

Overall Category: Tool
Updated: July 2004

Owner/Sponsor Organization: NexGen Ergonomics, Inc.
http://nexgenergo.com , www.humancad.com

Point of Contact Information:
Mr. David Pinchefsky, President
514-685-8593 FAX: 514-685-8687
pinchefsky@nexgenergo.com

Product Specific Web Site:
http://www.nexgenergo.com/ergonomics/mqbe.html
http://www.nexgenergo.com/ergonomics/mqpro.html
http://www.nexgenergo.com/ergonomics/mqelite.html
http://www.humancad.com/products/mqbe.html
http://www.humancad.com/products/mqpro.html
http://www.humancad.com/products/mqelite.html

General Overview:
ManneQuinBE/PRO/ELITE are Windows-based human modeling and ergonomic design programs. Equipped with a set of 2-D/3-D modeling and editing tools, the software features 3-D humanoid figures for multiple populations and numerous percentiles and body types. Each system is equipped with import/export tools to be used with graphics software such as AutoCAD and 3-D Studio Max. ManneQuinBE provides a basic set of human modeling tools. ManneQuinPRO provide additional features or functionality including the revised NIOSH lifting equation, 3-D biomechanical predictions, five levels of mannequin representation, frame-by-frame animation, and field-of-view and reach cones. ManneQuinELITE supports additional file formats such as STEP, IGES and STL as well as includes an interface to the University of Michigan's 3D SSPP program.

ManneQuinBE/PRO/ELITE are used in Human Factors design and ergonomic job evaluations.

Equipment/Software Required:
ManneQuinBE/PRO/ELITE are Windows-based human modeling and ergonomic design programs. Equipped with a set of 2-D/3-D modeling and editing tools, the software features 3-D humanoid figures for multiple populations and numerous percentiles and body types. Each system is equipped with import/export tools to be used with graphics software such as AutoCAD and 3-D Studio Max. ManneQuinBE provides a basic set of human modeling tools. ManneQuinPRO provide additional features or functionality including the revised NIOSH lifting equation, 3-D biomechanical predictions, five levels of mannequin representation, frame-by-frame animation, and field-of-view and reach cones. ManneQuinELITE supports additional file formats such as STEP, IGES and STL as well as includes an interface to the University of Michigan's 3D SSPP program.

Input/Output/Processing:
Input is CAD files or other data as required for design or analysis to be performed. Output is CAD file or .mqp file with human models.

Documentation:
Manual, tutorial, and program help

Stage of Development:
ManneQuinBE Version 2.6, ManneQuinPRO Version 10, ManneQuinELITE V1.0

Date Current Version Released:
2004

How To Acquire:
Point of Contact listed above.

Title: MANPRINT in Test and Evaluation

Overall Category: Tool
Update: June 1998

Owner/Sponsor Organization: Army Research Laboratory (ARL/HRED)

Point of Contact Information:
Integration Methods Branch Chief
410-278-6237 DSN**:** 298-6237

General Overview:
This method consists of two equations for predicting manned system performance, given sample data which describes soldier performance and hardware and software reliability. The first equation calculates the effectiveness of the system by numerical answer to the question, "How well does the system work when it works?" The second equation uses operating times for tasks (including the seven maintenance tasks described in MIL-STD-721), stand-by time, corrective and preventive maintenance times, and administrative and logistic down time. Those times are used to calculate the availability of the manned system (or the numerical answer to the question, "How often does the system work?"). The document explains the construction of the two equations and provides detail of calculating the soldier performance terms in each equation together with illustrations.

This method is appropriate for planning a full-scale MANPRINT evaluation of a soldier-machine system. All six MANPRINT domains are addressed and performance effects of those six domains can be calculated. The reference contains both explanation and example.

The output of this method is used to evaluate quantitatively how well and how often a soldier-machine system will work in the field.

Input/Output Processing:
The inputs necessary for this method are soldier performance data (time and accuracy of critical operations and maintenance tasks; soldier aptitude data (Armed Services Vocational Aptitude Battery (ASVAB) Profile); training data including time, cost, and end-of-training comprehension test scores; human factors engineering analysis; a safety assessment report; and a health hazard assessment report.

The processing of the input is the completion by hand of the worksheets from the reference noted in this summary.

The outputs consist of probabilities of correct soldier performance of each critical operations and maintenance task within time constraints; probabilities of correct soldier performance of all critical operations and maintenance tasks within time constraints; the system effectiveness (including soldier performance); and the system availability (including soldier performance).

Documentation:
Lowry, J. and Seaver, D., "Handbook for Quantitative Analysis of MANPRINT Consideration in Army Systems," ARI Research Product 88-15, 1986.

Alternative/Comparable Approaches:
Scott, J., et al., "Task Aptitude Template: A MANPRINT Methodology for Identifying Aptitude-Sensitive Critical Tasks," Draft Report, San Diego, CA: Cubic Defense Systems, Inc., Human Resources Test and Evaluation Systems (HRTES), 1987.

Stage of Development:

Completed. The reference document can be obtained through the Defense Technical Information Center, Technical Report AD A199620 (ARI RP-8815).

Date Current Version Released:
1986

Comments:
The first reference under Alternative Approaches addresses personnel and training. It identifies which critical tasks of a developing system show performance differences as a function of soldier aptitude and training. The second reference under Alternative Approaches describes the predecessor methodology to this handbook. HRTES was prepared for essentially the same purpose and scope.

How To Acquire:
Defense Technical Information Center (DTIC):
Search DTIC Public STINET http://stinet.dtic.mil/ or
Contact DTIC: Defense Technical Information Center, Reference and Retrieval Division, ATTN: DTIC-BR, 8725 John J. Kingman Rd., Ste. 0944, Ft. Belvoir, VA 22060-6218. Phone: (703) 767-8274 / DSN 427-8274.

Title: Micro Saint Sharp

Overall Category: Tool
Update: August 2004

Owner/Sponsor Organization: Micro Analysis and Design, Inc.
http://www.maad.com/

Point of Contact Information:

Mr. Ben Archer
303-442-6947 FAX: 303-442-8274
barcher@maad.com

Product Specific Web Site:
http://www.maad.com/index.pl/micro_saint

Built off the very successful Micro Saint engine, but completely redesigned to be faster, modular and more powerful! Micro Saint Sharp is a general purpose, discrete-event simulation software tool. Micro Saint Sharp's intuitive graphical user interface and flow chart approach to modeling make it a tool that can be used by generalists as well as simulation experts. Micro Saint has proven to be an invaluable asset in both small businesses and Fortune 500 companies and in many areas including the military, human factors, health care, manufacturing, and the service industry.

Micro Saint Sharp's power, flexibility and tools for optimization make it the simulation tool of choice for any organization. With a computer model of your process built in Micro Saint Sharp, you can begin to get the answers to your "what if" questions. What if I change the way humans work with the system? What if I change my resource mix? What if I rearrange the process? Find the answers with Micro Saint Sharp quickly and completely for systems of all sizes, shapes, and complexities.

Any process that can be represented by a flowchart can be simulated using Micro Saint Sharp. Features include 1) two views: one for model development and one for animation, 2) model optimization that automatically searches for and finds optimal solutions to simulation models, and 3) automatic data collection for queues, resources, and tasks.

It can be used to answer questions about the costs of alternative training, about how crew workload levels or reaction times affect system performance, and about the allocation of functions between people and machines. The outputs can be used to answer questions about how the system will perform under a variety of conditions. Users can build models in Micro Saint Sharp that help predict the effect of changes to a system before committing resources to implement the change. The models can also be used to conduct a sensitivity analysis on the variables in the system.

Equipment/Software Required:
The minimum system requirements for Micro Saint Sharp are Microsoft Windows Server 2003, XP Professional, XP Home Edition, ME, 2000 and 98 (operating systems must support the .NET Framework 1.1), 90-Megahertz Intel Pentium-class processor, 64MB RAM, 150MB of hard disk space and CD-ROM drive for installation.

Input/Output/Processing:
Micro Saint Sharp requires the following inputs: (1) a list of the tasks in the system; (2) estimates of the mean and standard deviation of the performance times; (3) the sequence and branching logic of the tasks; and (4) any resources that are consumed, processed, or generated by each task. System-specific information that affects the performance of the system being modeled also can be entered (e.g., environmental data). Input data can be retrieved automatically from another software application.

Micro Saint Sharp executes a discrete-event simulation model. This model uses the stochastic branching logic, task interactions, and performance estimates to generate results that predict the range of system outputs. This analysis is difficult and time consuming to do by hand, due to the stochastic nature of most systems.

Micro Saint Sharp automatically outputs task timelines, graphs, and tables of system performance statistics. Automatic data collection is provided for queues and tasks. Users can also generate statistics on any variable they have added to the system (e.g., resource utilization, skill acquisition, workload level).

Micro Saint Sharp output can be exported to other application programs for additional processing, and is contained in an XML file. Output data can be sent automatically to another software application.

Documentation:
Micro Saint contains extensive online Help to assist users. In addition, there is a preferred customer website that gives users access to software updates, documentation updates and troubleshooting information.

Micro Saint Sharp 1.0 User Guide, 2003

Bolin, S.F., Nicholson, N.R., and Smootz, E.R., "Crew Drill Models for Operational Testing and Evaluation," paper presented at MORIMOC II Conference, Military Operations Research Society, Alexandria, VA, 22 Feb 1989.

Dahl, S.G., Drews, C.W., Kelly, K.J., and Plott, C.C., "MicroSAINT: A Simulation Tool for the Human Factors Professional," Computer Systems Group Bulletin, Vol. 14, No. 1, March 1987.

Tijerina, L. and Treaster, D., "MicroSAINT Modeling of the Close-in Weapon System (CIWS) Loading Operation: Internal Validation and Sensitivity Analysis," Paper presented at MORIMOC II Conference, Military Operations Research Society, Alexandria, VA, 22 Feb 1989.

Alternative/Comparable Approaches:
The core of Micro Saint is embedded in the Army Research Laboratory's HARDMAN III products, in the Human Operator Simulator (HOS V), and in the Integrated MANPRINT Tools (IMPRINT). A version of the engine is embedded in the software for the Army Research Laboratory's Crew Reduction in Armored Vehicles Ergonomic Study (CRAVES). Additionally, Micro Saint's engine is included in the Air Force's Manpower, Personnel, and Training Decision Support System (MPTDSS).

Stage of Development:
Current Version: Micro Saint Sharp Version 1.1. Enhancements are added annually. New versions are available to government users at a cost.

Date Current Version Released:
March 2004.

Comments:
Training and technical support are available.

How To Acquire:
Contact listed above or email: sales@maad.com.

Title: MVTA (Multimedia Video Task Analysis)

Overall Category: Tool
Updated: July 2004

Owner/Sponsor Organization: NexGen Ergonomics Inc
http://www.nexgenergo.com

Point of Contact Information:

Mr. David Pinchefsky, President
514-685-8593 FAX: 514-685-8687
pinchefsky@nexgenergo.com

Product Specific Web Site:
http://www.nexgenergo.com/ergonomics/mvta.html

General Overview:
MVTA analyzes repetitive tasks that have been videotaped. The system enables users to obtain data on repetitions and time from videotape or AVI files. Users can identify events interactively with the use of breakpoints in the video record that identify the start and end of events. The video can be analyzed at any speed and in any sequence. The program also produces time study reports and computes frequency of occurrence for each event. Video images can be digitized.

MVTA is used for ergonomic job evaluations, time and motion studies.

Equipment/Software Required:
IBM PC or compatible with W95/98/Me/NT/W2000/XP.

Input/Output/Processing:
Input: video, AVI and MPEG files.

Output: statistical reports.

Documentation:
Manual and tutorial.

Stage of Development:
V 2.92

Date Current Version Released:
2004

How To Acquire:
Point of Contact listed above.

Title: The Observer

Overall Category: Tool
Updated: August 2004

Owner/Sponsor Organization: Noldus Information Technology, Inc
http://www.noldus.com/

Point of Contact Information:
Mr. John J. McGraw, BSE
1-800-355-9541 FAX: 703-771-0441
john@noldus.com

Product Specific Web Site:
http://www.noldus.com/products/observer/obs_biblio.htm

General Overview:
The Observer is a professional system for collection, analysis and management of observational data, and for 'live' data entry by a human observer, or from videotape, using a desktop or hand-held computer. The Observer is the ultimate system for the collection, analysis, presentation and management of observational data. It can be used to record activities, postures, movements, positions, facial expressions, social interactions, or any other aspect of human or animal behavior.

Used for human ergonomics studies: task analysis, labor and time studies, efficiency research, man-machine interfaces, human-computer interaction.

Provides presentation of numerical data for export to spreadsheet or statistical package; direct use in reports.

Equipment/Software Required:
486 CPU or higher Personal Computer; Windows 95 or higher; 16 MB RAM; 20 MB hard drive; VCR, if working from video; MPEG encoder, if working with digital video files; optional: video recorder with serial interface, video overlay board (can be purchased from Noldus Information Technology, Inc.).

Input/Output/Processing:
Designed for data entry by a human observer, The Observer is the logical successor of paper and pencil. You can enter data directly into a PC or hand-held computer, or code events from videotape or digital media file. No more time-consuming and error-prone data transcription -- analysis reports are available instantly. These supply you with objective and quantitative data for direct conclusions or further research.

Once data collection has been completed, powerful analysis options are only a few keystrokes away. You can explore your data in time-event tables and plots, or generate reports with statistics on frequencies and durations, the sequential structure of the process, or the co-occurrence of events. Results can be displayed onscreen, printed on paper, or saved in a file on disc.

For additional calculations and inferential analysis (hypothesis testing), you can export the summary tables to spreadsheets, databases, or statistics packages. The Observer formats the output for the package of your choice. When working with video, the system can create highlight tapes.

Documentation:
Extensive user manual comes with software.

Alternative/Comparable Approaches:
Pencil and Paper

Stage of Development:
Version 4.1

Date Current Version Released:
May 2003

Comments:
Hours of training required: 16

How To Acquire:
Point of Contact listed above. Alternate phone number is: 703-771-0440.

Title: Operational Requirements-Based Casualty Assessment System (ORCA)

Overall Category: Tool
Update: April 2003

Owner/Sponsor Organization: Army Research Laboratory (Survivability/Lethality Dir)
http://www.arl.army.mil/slad/

Point of Contact Information:

Mr. Ed Davis
410-278-6309 DSN: 298-6309
edavis@arl.army.mil

General Overview:

The Operational Requirements-Based Casualty Assessment System (ORCA) model provides new methodology for assessing the anti-personnel effects associated with various munitions-produced damage mechanisms. This model is the product of the Crew Casualty Working Group, a joint Army, Navy, Air Force project under the JTCG/ME & JTCG/AS organizations. Development of this model was prompted by concern for computation of user casualties.

The Crew Casualty Project was tasked to produce a methodology and computer code to evaluate personnel casualties: 1) for all (conventional) insults (blasts, burns, bullets, etc.); 2) for any crew position (pilot, gunner, infantry, etc.); and 3) consistent with the needs of the medical community.

The assumptions, constraints, and salient features were: 1) the problem begins at "the skin"; 2) operational casualties only; 3) no medical treatment; 4) no motivational effects; and 5) strong reliance on adaptation of existing models.

The ORCA model combines the best features of several existing models, and combines them in a way that allows consistent assessment of casualties across virtually all platform, job, and threat types. ORCA is an automated, interactive model with which conditions can be changed "on the fly" to assess various outcomes.

The ORCA computer code allows one to calculate anatomical damage and the effect on individual performance of exposure to kinetic energy (fragment), thermal, chemical, directed-energy (laser), blast, and accelerative loading threats. In each case, the effect of a computed injury is characterized by the predicted impairment of each of 24 human elemental capabilities (e.g., vision, cognition, and physical strength). Post-injury capability is then compared to capability requirements associated with the individual's military job, task, or mission to determine whether he/she is an operational casualty. Code outputs for discrete exposures (e.g., a single-fragment impact) include a physical damage summary, details of any deleterious processes (e.g., blood loss), AIS score, elemental capability status, and remaining performance capability (comparable to incapacitation) as a function of time after wounding (six time periods ranging from immediate to 72 hours). In addition to discrete simulations with single threats, ORCA can also be run in GRID or batch mode to produce results that reflect a range of exposure conditions.

Ability to assess the immediate and longer-term capabilities of an operator, and the level of injury caused by the initial result. This, in turn, can be used in assessing munition effectiveness, protective equipment needs, medical field unit and battle planning, as well as war gaming simulations. The model can be used in a stand-alone, high-resolution mode to examine specific single-event exposures, or offline to generate output databases which will lead to generalized correlation curves.

Equipment/Software Required:

Unix machine.

Input/Output/Processing:
The ORCA code allows the user to specify the operational requirement for a military job, task, or mission by selecting from a library of 18 military occupations (MOS, NEC, or AFSC), specific military tasks, or predefined mission scenarios. Users can also build a customized requirement with assistance from the available task library.

Results are displayed on the screen. Data includes: description of anatomical damage and associated deleterious processes; post-injury capabilities broken down into 24 discrete areas (e.g., night vision, psychomotor mental processing, arm/hand dexterity, etc.), and residual performance at 6 post-injury time frames (immediate, 30 sec., 5 min., 1 hr., 24 hrs., 72 hrs.).

Documentation:
The code provides extensive online help, and will be supported by a User's Guide and Technical Manual when released.

Alternative/Comparable Approaches:
ORCA predecessor models include: ComputerMan (USA); Cheman (USA - now a module in ORCA); INJURY (USA); Articulated Total Body (USAF); and BURNSIM (USAF)

Stage of Development:
Alpha Version 2.08; beta version in test; beta version available at the end of 1997.

Validation:
Two validation efforts are currently in progress. Both will involve the use of expert panels to review the overall methodology, as well as the data and algorithms incorporated in ORCA. Two additional efforts are planned for 1998, which will address the validation of the military job/task/mission information, as well as the Injury-to-Impairment mappings.

Comments:
Alternate POC: Mr. J. Terrence Klopcic, 410-278-6322 / DSN 298-6322 / FAX 410-278-4684

How To Acquire:
Point of contact and alternate listed above.

Title: Operator Workload Knowledge-Based Expert System Technology (OWLKNEST)

Overall Category: Tool
Update: August 2004

Owner/Sponsor Organization: U. S. Army Research Institute for the Behavioral and Social Sciences
http://www.ari.army.mil

Point of Contact Information:

Dr. Richard E. Christ
706-545-2207 DSN: 835-2207 FAX: 254-287-9873
christr@benning.army.mil

General Overview:

OWLKNEST is a microcomputer-based methodology that guides selection of the appropriate techniques for assessing Operator Workload (OWL) in developing Army systems. It is based on knowledge acquired during a multi-year OWL research program.

This method has potential impact on trade-off studies involving all the MANPRINT domains. The method is applicable across all phases of the materiel acquisition process.

The outputs of OWLKNEST serve as a guide to indicate the order in which the user should consider applying the techniques. The user can optionally access the rules to see what parameters were influential in the determination of the ranking of techniques, and hence gain insight on the appropriateness of the OWL techniques at different points throughout the materiel development cycle. OWLKNEST also can be used in a sensitivity analysis mode by changing one or more responses given. In this mode, the user will be provided with information on which to base decisions as to whether additional resources should be allocated to the OWL assessment effort.

Equipment/Software Required:

OWLKNEST requires an IBM-compatible PC with 640 Kb memory and DOS 2.0 or higher. A run-time version of Exsys Professional, an expert system shell, is included.

Input/Output Processing:

OWLKNEST assumes that the users have fundamental knowledge of OWL concepts; however, they can be computer novices. A question-and-answer dialogue, supplemented by embedded help features, drives user input to OWLKNEST. Input consists of requirements and system characteristics related to prospective system operators.

The expert system applies rules and knowledge provided by workload domain experts. OWLKNEST knowledge is organized based upon a taxonomy that divides OWL techniques into analytical and predictive techniques, which can be applied early in the system design, and empirical techniques, which are applied later when an operator is in the loop during simulator, prototype, or system evaluations.

The output of OWLKNEST is a list of OWL techniques with a ranking of high, average, or low applicability. The rankings are based on cumulative probabilities that the system builds with each question answered by the user. The user also can obtain one-page descriptions of the recommended techniques including implementation requirements, references, and points of contact.

Documentation:

Harris, R.M., Hill, S.G., Lysaght, R.J., and Christ, R.E., "Handbook for Operating the OWLKNEST Technology (HOOT)," ARI Research Note 92-49, U.S. Army Research Institute for the Behavioral and Social Sciences, Alexandria, VA. (DTIC No. ADA253412)

Alternative/Comparable Approaches:
Hart, S.G., Shively, R.J. and Casper, P.A., "Workload Consultant for Field Evaluation (WC FIELDE)," Moffett Field, CA: NASA Ames Research Center, 1988.

Stage of Development:
Mature.

Date Current Version Released:
June 1992

Comments:
While OWLKNEST has not been updated since its release in 1992, it continues to address issues relevant to conducting an OWL analysis. This relevance is probably due to the fact that there has been little relevant research and no new methodology developed to assess workload over the past decade.

Individuals needing a comprehensive overview of the concept of mental workload and methods available to measure it might wish to look over the publications that resulted from the multiyear operator workload research program conducted by the U.S. Army Research Institute. These publications are listed below – in chronological order of their publication. The AD numbers at the end of most of these references refers to their accession numbers in the Defense Technical Information Center (DTIC) database of technical reports. DTIC can be accessed through its website: http://www.dtic.mil.

Lysaught, R.J., Hill, S.G., Dick, A.O., Plamondon, B.D., Linton, P.M., Wierwille, W.W., Zaklad, A.L., Bittner, A.C., & Wherry, R.J. (June 1989). *Operator Workload: Comprehensive review and evaluation of Operator Workload Methodologies* (Technical Report 851). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. (AD A212 879)

Christ, R.E., Bulger, J.P., Hill, S.G., & Zaklad, A.L. (September 1990). *Incorporating operator workload issues and concerns into the systems acquisition process: A pamphlet for Army managers* (Research Product 90-30). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. (AD A228 489)

Harris, R.M., Hill, S.G., Lysaught, R.J. & Christ, R.E. (June 1992). *Handbook for operating the OWLKNEST technology (HOOT)* (ARI Research Note 92-49). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. (AD A253 412)

Sams, M.R. & Christ, R.E. (July 1992). *Assessment of workload in a field environment: Implications for some unresolved workload issues* (Technical Report 958). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. (AD A256-651)

Hill, S.G., Iavecchia, H.P., Byers, J.C., Bittner, A.C., Zaklad, A.L., & Christ, R.E. (1992). Comparison of four subjective workload rating scales. *Human Factors, 34*(4), 429-439.

Christ, R.E., Hill, S.G., Byers, J.C., Iavecchia, H.M., Zaklad, A.L., & Bittner, A.C. (March 1993). *Application and validation of workload assessment techniques* (Technical Report 974). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. (AD A395 672)

How To Acquire:
The Point of Contact listed above will provide a floppy disk of the software.

Title: Parameter Assessment List - MANPRINT Automated Tool Edition (PAL-MATE)

Overall Category: Tool
Update: August 2004

Owner/Sponsor Organization: Army Research Laboratory (ARL-HRED)
http://www.arl.army.mil/

Point of Contact Information:

Dr. Donald B. Headley
410-278-5919 DSN: 298-5919 FAX: 410-278-5940
dheadley@arl.mil

General Overview:
To support the assessment process of MANPRINT's newest domain, called Soldier Survivability, the Army Research Laboratory's Human Research and Engineering Directorate and Survivability/Lethality Analysis Directorate have developed an assessment guideline, referred to as the Parameter Assessment List (PAL). The List consists of rating sheets which outline a series of issues under each of six broad categories. This methodology is currently a paper-and-pencil process. The completion of the rating sheets can be a time-consuming and onerous process. An automated version would alleviate these problems. Additionally, because multiple agencies contribute to an assessment, an automated format would provide more conformity in domain report assessment and preparation. The PAL-MATE is a PC-based automated version of the PAL. PAL-MATE, like the manual PAL, is a comprehensive accounting of what to rate, but not how to rate it.

PAL-MATE is intended for performing Soldier Survivability (SSv) domain assessments. The assessment of each SSv Component is sent to the Integration Office of SLAD for roll-up into a SSv Domain Report.

Equipment/Software Required:
IBM-compatible with at least 386 CPU, 4 megabytes RAM, hard disk drive with 15 megabytes of free space, Windows 3.1 (or higher).

Input/Output/Processing:
The analyst rates each SSv issue according to a Severity Scale of N/A (not applicable), None, Minor, Major, and Critical (the rating is entered by clicking on the appropriate scale item). Text pertaining to a given issue can be entered into a Comments box.

PAL-MATE is coded in Borland C++. SSv issues are rated one at a time. The tool's features include: a) a user-friendly front-end interface; b) a menu to easily select a given portion of the PAL to work on; c) rating sheet screens which allow easy cursor maneuverability; d) navigation aids which tell the user where he is in the system; e) embedded user guide with table of contents which allows section selection; f) provision for easy changes to be made to the issues contained in the rating sheets (additions, deletions, edits); g) roll-up of information from the issue level to the component-level summary sheets; h) search; i) glossary; and j) report generation.

A screen or paper report sorts the ratings of SSv issues by the Severity Scale of N/A, None, Minor, Major, and Critical. Any accompanying comments are also attached to each issue.

Documentation:
PAL-MATE User's Guide.

Alternative/Comparable Approaches:
Procedures Manual for Soldier Survivability Assessments, May 1994 (paper-and-pencil manual version).

Stage of Development:
Completed.

Date Current Version Released:
April 1996

Comments:
Distribution is unlimited for DoD and US DoD contractors. Some distribution restrictions may apply to organizations outside of DoD. Please contact the POC for an availability determination.

How To Acquire:
To obtain, write: Director, U.S. Army Research Laboratory
Survivability/Lethality Analysis Directorate
ATTN: AMSRD-ARL -SL-BE (Richard Zigler)
Aberdeen Proving Ground, MD 21005-5068
Email: rzigler@arl.army.mil
(410) 278-8625
DSN 298-8625

Title: Relex Human Factors Risk Analysis (HFRA) Software Module

Overall Category: Tool
Updated: January 2005

Owner/Sponsor Organization: Relex Software Corporation
http://www.relex.com

Point of Contact Information:

George Gross
724-836-8800 x 104 FAX: 724-836-8844
george.gross@relex.com

Product Specific Web Site:
http://www.relexsoftware.com/products/humanfactors.asp

General Overview:
Relex Human Factors Risk Analysis is based on a PFMEA (Process Failure Mode and Effects Analysis) approach. Modeling a human process using this format is known as an HF-PFMEA, or Human Factors Process Failure Mode and Effect Analysis. PFMEAs are primarily used to assess the safety and reliability of a process by analyzing potential failure modes of the process. Taking this to the next level, HF-PFMEAs can be used to assess the human safety and human reliability by analyzing human processes or tasks.

The analysis begins by breaking down a process into discrete tasks so that the actions associated with each task can be specifically analyzed for potential human failure. Each possible error is then evaluated to identify positive and negative contributing factors, barriers, and controls.

Contributing factors identify elements that may increase or decrease the possibility for error, such as poor lighting (a negative) or employee training (a positive). Barriers are items that help to prevent a person from committing an error, such as a switch guard. Controls are elements put into place to detect and/or correct an error, such as inspections.

To allow the user to perform this analysis in the most efficient manner, Relex Human Factor Risk Analysis offers a unique *Data Entry Wizard* to walk the analyst through each step of the process. The Data Entry Wizard is useful for both the novice and expert user, providing guidance and ensuring a well-organized and comprehensive analysis.

Additionally, Relex Human Factors Risk Analysis includes a comprehensive database of errors, contributing factors, barriers, and controls. The lists provided are auto-sensing so that selections are intelligently compiled based on prior data. This library of information can also be augmented by the analyst if required.

Equipment/Software Required:
Windows-based PC.

Input/Output Processing:
Inputs include building your process tree; assignment of action verbs to each process step (drop-down list); assignment of potential human errors (drop-down list) associated with each action verb; and assignments of performance shaping factors along with impact (+/-), barriers, controls, likelihood of error, likelihood of effect and severity of effect (all drop-down lists) for each human error.

Processing includes ranking of Criticality and calculation of Risk Assessment Codes (RAC) by error.

Outputs include standard reports, and NASA's 5x5 Criticality Matrix. Based on NASA-developed thresholds, high-risk errors may then either be reviewed in order to reduce negative-impact performance shaping factors, increase positive-impact performance shaping factors, add barriers or add controls in an effort to reduce the criticality of the error.

Documentation:
Embedded help feature is included with the software package.

Stage of Development:
First product release.

Date Current Version Released:
9/2004

Validation:
NASA usability testing.

Comments:
Development originally funded through NASA's Office of Safety and Mission Assurance. Now commercially available through Relex Software Corporation.

How To Acquire:
George Gross, Application Consultant, the POC listed is the person to contact to procure the product.

Title: Reliable Human-Machine System Developer (REHMS-D)(tm)

Overall Category: Tool
Updated: July 2004

Owner/Sponsor Organization: KPL Systems
http://pages.prodigy.net/kplsys/kplsys.htm

Point of Contact Information:

Dr. Kenneth P. LaSala, Director
301-625-9457 FAX: 301-384-7853
kplsys@prodigy.net

Product Specific Web Site:
http://pages.prodigy.net/kplsys/rehms.htm

General Overview:
The Reliable Human-Machine System Developer (REHMS-D)(tm) is a major advance in system and reliability engineering that has broad application to systems and processes. REHMS-D uses a six-stage system engineering process, a cognitive model of the human, and operational sequence diagrams to assist the designer in developing human-machine interfaces subject to top-level reliability or yield requirements. Through its system engineering process, REHMS-D guides the designer through the understanding of customer requirements, the definition of the system, the allocation of human functions, the basic design of human functions, the assignment of job aids, and the design of tests to verify that the human functions meet the allocated reliability requirements. REHMS-D can be used for both the synthesis of new systems and the analysis of existing systems.

System and process designers can apply REHMS-D to many subjects. For example, REHMS-D can be used to synthesize or analyze radar and sonar systems, control rooms and control systems, communications systems, geographic information systems, manufacturing processes, maintenance processes, biomedical systems, transportation systems, and other systems and processes that involve human-computer interfaces.

REHMS-D includes the following features to assist designers in obtaining high levels of reliable human performance: operational sequence diagrams for rapid system or process visualization; online help in selecting environments and interface characteristics, warning when safe levels are exceeded; two levels of sensitivity analysis to allow identification of opportunities for improvement; choices for types of inputs to the operator and responses by the operator; and graphical displays of test plans. When the user desires, REHMS-D creates interface specifications for selected human functions.

Equipment/Software Required:
Personal computer, Windows 95, 98, XP, mouse.

Input/Output Processing:
Data on: situational characteristics -- illumination, atmospheric conditions, temperature, pressure, humidity, ambient noise, motion/vibration; and on psychological stressors – task load, task duration, skill level.

Uses reliability as a metric for selection of human interface and task parameters.

Screen-displayed analysis results. Results also may be printed.

Documentation:
The REHMS-D software includes online help screens. REHMS-D is sold with a printed user manual that describes both the overall REHMS-D concept and the detailed procedures for using REHMS-D. A one-day training course is available.

Alternative/Comparable Approaches:
There are no other computer-based decision support products like REHMS-D. No other product provides human performance reliability-oriented decision support as the user proceeds from establishing system requirements through design and test.

Stage of Development:
REHMS-D is available commercially as REHMS-D Version 1.1. A limited number of beta site licenses are available at a reduced price to support future development.

Date Current Version Released:
1995

Validation:
The validation subject for REHMS-D was the circuit board manufacturing process of a major U.S. electronics manufacturer. REHMS-D predictions were compared with process performance data. The validation was useful to the manufacturer because it showed how the process yield could be increased by changes that improved human performance in process tasks.

Comments:
REHMS-D may be obtained under license under a standard commercial agreement, or may be obtained at a reduced price under a beta site agreement. More information about REHMS-D can be found at the World Wide Web site.

How To Acquire:
Point of Contact listed above.

Title: Requirements Management Strategy (RMS)

Overall Category: Tool
Update: August 2005

Owner/Sponsor Organization: Naval Air Warfare Center - Weapons Div (NAWCWPNS)

Point of Contact Information:
Ms. Gene Schneider
House of Hrair
760-384-8532
gschneider@iwvisp.com

General Overview:
The Requirements Management Strategy (RMS) is an integrated system to capture, control, and communicate project requirements, including change management and metrics. It specifically supports the "world views" of sponsors, users, system engineers and software engineers.

The Strategy consists of:

1. Three tailored MIL-STD-2167 requirements documents:
   Document A: for sponsor/manager & operator/user views.
   Document B: for the system engineering view, including allocation of requirements to test modes, media (hardware, software, and liveware), and subsystems.
   Document C: for the subsystem/software engineering view.

2. Two databases:
   Requirements tracking/documentation database (called RAT)
   Functional Hierarchy database (# - see below)

3. Three implementing processes:
   Project Specification (Project Development Phase 1)
   System Requirements Analysis (Phase 2a)
   Software Requirements Analysis (Phase 2b)

(#) All documents, and the requirements database, are required to be organized according to the Functional Hierarchy for the project, for the project, which is developed and approved in the Project Specification phase.

RMS is used to manage all aspects of project requirements, including documentation, dissemination, traceability, and change control. The method was designed for projects that use the system development MIL-STD, specifically post-deployment aircraft projects. But the method is both generic and flexible, and is not constrained for use only with military systems.

Equipment/Software Required:
The method does not require particular hardware or software. The current implementation uses:
1. WORD for documents, memos, etc.
2. FileMaker Pro for databases.

These applications operate on both Macintosh and PC computers.

Input/Output Processing:

System/project requirements, in any form in which they may exist.

Functional Hierarchy for the system/project, that is:
1) complete (there is a place in it to put each requirement); and
2) non-redundant (there is exactly one such place).

Results of various analyses, such as how requirements will be tested, and allocation of requirements to subsystems.

For the requirements database, considerable analysis must be done to determine the boundaries between one requirement and another, and what parts of the requirement definition belong in the name, description, implementation, and comments fields in the database. The requirements must be given unique identifiers, consisting of a Functional Hierarchy ID and a "sequence number" to order the individual requirements assigned to each hierarchy item.

Requirements documents
Requirement traceability tables
Other special RAT outputs (such as presentation slides)

Documentation:
"Requirements Management Strategy," (IEEE presentation), NAWCWPNS (C2103),China Lake, CA, May 94.

"Requirements Documents in the Context of the Requirements Management Strategy (RMS)," NAWCWPNS (C2103), China Lake, CA, April 94.

Alternative/Comparable Approaches:
The MIL-STD for software development (MIL-STD-2167) is an alternative. The Software Engineering Institute (Carnegie Mellon University) Capability Maturity Model, Requirements Management Key Process Area is another alternative. Projects developed according to the RMS method can be completely compliant with the requirements of both of these alternative methods. As said above, the RMS method is generic and flexible.

Stage of Development:
The method is fully operational. Like all TQM methods, it is continually being improved. Hard copies of the references, and soft copy of document and database templates, are available from the POC.

Comments:
See HSI record number 92 for a more detailed description of the requirements database (RAT), and the Functional Hierarchy database that supports it.

How To Acquire:
Point of contact listed above.

Title: RiskSafe™ – Workplace Job Hazard Analysis Software

Overall Category: Tool
Update: July 2004

Owner/Sponsor Organization: Dyadem International Ltd.
http://www.risksafe.com/

Point of Contact Information:

Mr. Steve Bondarewski
905-762-5211
sbond@dyadem.com

Product Specific Web Site:
http://www.risksafe.com/

General Overview:
RiskSafe ™ 5 is the most flexible computer software tool in the world for conducting qualitative workplace Job Safety Analysis (JSA) assessments for specific tasks or activities.

RiskSafe™ 5 enables safety engineers or ergonomists to systematically rank relative risk within a matrix or table, using values of probability and consequences to define decision criteria. Initially developed for heavy industries such as mining and automobile manufacturing, the discipline of Job Safety Analysis (JSA) is now widely found in many other types of industries including food processing, warehouse, retail and even clerical work. Since RiskSafe ™ 5 is such a flexible application that can be used to evaluate potential losses due to environmental problems, business interruptions, business image, public safety, etc.

This powerful tool will help you better identify and mitigate factors that may lead to an unsafe workplace.

Equipment/Software Required:
Windows 95, 98, NT, 2000, XP Operating System, 64 MGb or RAM, 200 Mhz Pentium or greater.

Documentation:
Full Software Manual.

Stage of Development:
Immediately available.

How To Acquire:
Contact Steve Bondarewski at 905-762-5211 or email: sbond@dyadem.com

Title: SAFEWORK(tm)

Overall Category: Tool
Update: August 1999

Owner/Sponsor Organization: GENICOM Consultants, Inc.

Point of Contact Information:
Mr. Robert Carrier
514-931-3000
robert@safework.com

General Overview:
SAFEWORK(tm) is a 3-D design analysis software for analyzing the interaction between humans and their workspace. This powerful man-modeling tool quickly creates virtual male or female mannequins of various percentiles, based on U.S. Army statistics, that the user can adjust to accommodate critical variables or a targeted percentage of the population. The software is designed to resolve a majority of ergonomic problems during the design stage.

SAFEWORK(tm) creates humans of various percentiles to study fit and accessibility in a workspace. The software permits generation of mannequins using percentiles or absolute values for up to 103 anthropometric variables. The unspecified variables are calculated automatically with a statistic-based algorithm. Numerous forms of analysis can be done, including postural analysis, reach, and access studies, along with a sophisticated vision module for sight analysis. Through the animation module, users can simulate tasks and optimize the work involved within the environment.

Acting as a Virtual Mockup, SAFEWORK(tm) allows the user to analyze the mannequins' ability to function within the imported CAD design, and perform the closest form of customization for all future users of the final design.

Equipment/Software Required:
Any Silicon Graphics workstation running IRIX 5.3 or greater; 24-bit color plane.

Input/Output Processing:
Using the SAFEWORK(tm) file parser, users import their CAD designs from a host CAD system. Most file formats are accepted, including IGES, OBJ, DXF, COOR, and SWX. The user then defines the critical variables necessary to analyze the design, and simulates the mannequins' activities within the environment to ensure optimal functioning.

The program uses MOTIF to create a multiple-windows environment with standard graphics interface. Mannequins can be represented using links, ellipses, lines, and flat and Gouraud shading. Mannequin sex and morphological profile can also be specified, including seven somatotypes from ectomorphs to mesomorphs

SAFEWORK(tm) mannequins are generated by using multi-normal modeling techniques. Upon user's inputs of critical variables, a special boundary mannequin algorithm unique to SAFEWORK(tm) automatically adjusts all other anthropometric variables based on statistical correlations. This process assures the user that the desired percentage of the population is accommodated, and that the mannequins do exist in the population.

Mannequin movement is performed using Direct or Inverse Kinematics. Seven Inverse Kinematics handles control of the movement of the mannequin, and predicts the natural motion behavior. The Direct Kinematics mode consists of 99 independent links and 148 degrees of freedom, which takes into account the limits of joint mobility, and supports coupled range-of-motion. Included in the mannequin's movement are a fully articulated hand and spine model.

The SAFEWORK(tm) interface consists of windows and pop-ups, along with a tool and status bar. The SAE's standard male and female percentile mannequins are used as the default. Any changes or adaptations to these mannequins are processed through the various modules:

Anthropometry Module: A pop-up that accesses 7 different morphological profiles and allows the user to define up to 103 anthropometric variables on the mannequin. These variables can be altered manually by inputting desired measurements in percentiles, unit measurements, or by a click-and-drag system. It also has the capacity to define the Mean and Standard Deviation based on the measurements entered.

Postural Analysis: A pop-up that permits the user to analyze posture, find postural scores, set functional limitations and range of motion, and analyze optimal comfort and positioning.

Vision Module: This module displays the mannequin's vision based on data taken from NASA 3000 studies. Four types of vision are available: binocular, ambinocular, and monocular left and right. The window also displays peripheric cones, blind cones, central cones, central spot, blind spot and line of sight. Furthermore, adjustable fields-of-view and distance attributes are incorporated.

Animation: Once the mannequin is properly positioned within the environment, the sequence of tasks can be animated to preview any trouble spots or major obstacles.

Collision Detection: By switching on Collision Detection, users can analyze at which point contact is made with surrounding objects without having to do so visually.

Documentation:
Documentation on SAFEWORK(tm) can be found in the form of a user's manual, along with a Basic and Advanced Training manual.

Stage of Development:
Having been functional for several years, SAFEWORK(tm) is continually evolving to reach market needs. Upcoming versions will include a highly defined surface modeling entitled, "Dual Krigeage".

Comments:
For general information on SAFEWORK(tm), please contact Andrew Wozny (Sales & Marketing Representative) at the same POC address specified above.

How To Acquire:
Point of Contact listed above.

Title: Santos ™

Status: Under Development
Updated: August 2005

Owner/Sponsor Organization: U.S. Army Tank-automotive and Armaments Command (TACOM)
http://www.tacom.army.mil/main/

Point of Contact Information:
Dr. Karim Abdel-Malek
University of Iowa, Virtual Soldier Research (VSR) Program
319-335-5676 FAX: 319-335-5669
amalek@engineering.uiowa.edu

Product Specific Web Site:
http://www.digital-humans.org/santos/

General Overview:
Santos is an optimization-based, autonomous virtual human. He is a soldier capable of accomplishing tasks on his own, unaided. The ultimate goal is to enable Santos to evaluate systems, components, and products before they are built, thus reducing significant costs associated with making prototypes. Ultimately, Santos will provide a design aid, a valuable tool for improving quality and reducing costs. In addition, Santos provides valuable feedback about the human body, concerning fatigue, comfort, joint loads, etc.

Santos was built from the ground up, using state-of-the-art technologies, and he continues to grow in dynamic capabilities and intelligent behaviors through integration of cognitive models, design optimization, and physics-based modeling. The mathematical model of a skeleton for Santos is developed based on the Denavit-Hartenberg method for kinematic and dynamic analysis. Optimization code is used to determine postures that are governed by various human performance measures (objective functions) and constrained by the restrictions imposed by the skeleton, physical constraints, and environmental constraints. This code must be as fast and efficient as possible in an effort to provide real-time simulations. Santos combines real-time performance, autonomous human motion that is not dependent of prerecorded actions, and extremely realistic appearance with deformable skin.

While Santos is performing a task, we are able to monitor his progress, both visually as you see him performing a task and analytically by simultaneously monitoring his musculoskeletal system and his vital signs (Santos has a continuous heart beat, a blood pressure, and an active metabolism).

Perhaps the most significant contribution we have made at VSR with Santos is dynamics without integration. This is a result of multi-disciplinary research combining kinematics, dynamics, optimization, physiology, and biomechanics.

Complete capabilities are listed on the following web site:
http://www.digital-humans.org/santos/SantosCapabilities.htm

Equipment/Software Required:
1) Reasonably modern PC with a comparable game-level graphics card
2) Virtools

Input/Output/Processing:
An intuitive, easy-to-use interface is provided, so the user can communicate with Santos. If desired, the user can provide unique body-characteristics, such as joint rotation limits, skeletal dimensions, and other biophysical parameters.

Santos exists in a real-time environment, thus providing immediate feedback/output.

Documentation:
Please see the following publications:

Dr. Jingzhou Yang, Tim Marler, HyungJoo Kim, Kimberly Farrell, Anith Mathai, Steven Beck, Professor Karim-Abdel Malek, Professor J.S. Arora, and Kyle Nebel, "Santos: A New Generation of Virtual Humans", *SAE 2005 World Congress*, April 11-14, 2005, Cobo Center, Detroit, Michigan

Professor Karim Abdel-Malek, Dr. Jingzhou Yang, Joo Kim, Tim Marler, Steven Beck, and Kyle Nebel, "Santos: A Virtual Human Environment for Human Factors Assessment", *24th Army Science Conference: Transformational Science and Technology for the Current and Future Force*, Orlando, Florida, November 29th-December 2, 2004

Kimberly Farrell, Dr. Jingzhou Yang, and Professor Karim Abdel-Malek, "Santos: A New Interactive Virtual Human", *SIGGRAPH 2004 Real-Time 3DX: Demo or Die*, Los Angeles, California, August 8-12, 2004

Dr. Jingzhou Yang, Tim Marler, Dr. HyungJoo Kim, Professor J.S. Arora, Professor Karim Abdel-Malek, "Multi-Objective Optimization for Upper Body Posture Prediction", *10th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference*, August 30 - September 1, 2004, Albany, New York

Additional publications are available at the following web address:
http://www.digital-humans.org/publications.htm

Alternative/Comparable Approaches:
Other virtual humans.

Stage of Development:
Under development.

Validation:
Experimental-based confirmation using motion capture.

Comments:
We have not released Santos to the public (nor will we do this in the foreseeable future). However, the Virtual Soldier Research group conducts both basic and applied research for companies that are interested in reducing their lead times and costs associated with making physical prototypes. We use Santos and many of our laboratories and facilities to accomplish the research. In the mean time, we also seek to debug the Santos environment while applying it to the many problems that have been posed to us by our industry partners.

How To Acquire:
For more information, refer to the Point of Contact listed above.

Title: Ship Manpower Analysis and Requirements Tool (SMART)

Overall Category: Tool
Update: February 2004

Owner/Sponsor Organization: Naval Surface Warfare Center - Dahlgren Division
http://www.nswc.navy.mil/

Point of Contact Information:

Mr. John Kimball
540-653-0783 FAX: 540-653-0831
KimballJD@nswc.navy.mil

General Overview:

The realization of optimal manning and ownership costs requires that the human be considered as a major component of the ship and its associated systems early in the acquisition process. Toward that end, systems engineers and manpower evaluators must have tools and processes to support the assessment of manpower decisions early in design, when a change in design is still affordable and achievable. The Office of Naval Research (ONR) and the Naval Surface Warfare Center (NSWC) recognized the need for tools to help analysts plan for, design, and most importantly, evaluate alternative manning and automation concepts prior to attempting to implement technology. To help meet these needs, ONR and NSWC sponsored the Ship Manpower Requirements and Analysis Tools (SMART) project. The primary product from this effort was the development of a manpower-modeling tool entitled SMART Build 3. A primary strength of SMART Build 3 is that it supports a flexible analysis approach through which a system designer can apply varying levels of fidelity to the analysis of manning and automation alternatives. The scope of the functional analyses includes shipboard operations, facilities maintenance, unplanned corrective maintenance, and preventative maintenance.

Equipment/Software Required:

Microsoft Windows 98, 2000, ME or XP environment (NOTE: will not execute on Windows NT or Windows 95 operating system)
- a high-resolution monitor
- a Pentium processor,
- approximately 100 MB of hard disk space
- a minimum of 64 MB of RAM to run efficiently. A minimum of 128 MB of RAM is recommended

Input/Output Processing: Input/Output/Processing:

Input:
Compartments, Equipment, Facilities/Preventive/Corrective Maintenance Schedules, Scenario(s), Functions, Function Sequence, Tasks, Task Sequence, Task Skill Requirements, Crew Assignment, Crew Skill level, Crew work parameters, Crew Cost, Equipment Usage. A large database of compartments, equipment, maintenance actions, job (rank/rating) skills, and job costs is included in the library database.

Output:
SMART Build 3 reports include:
- Operational Manpower Requirements
  Directed Manpower Requirements
- Job Utilization
- Utilization Over Time

- Overall Skill Usage
- Skill Usage Over Time
- Crew Composition
- Performance

- Mean Time vs. Actual Time
- Manpower Cost
- Equipment Cost
- Crew Requirement
- Facilities Maintenance Hit Matrix
- Prev/Corr Maintenance Hit Matrix
- Personnel Conflicts
- Planned vs. Actual Times Report

Processing:
Stochastic task network modeling is used to execute the operational and maintenance scenarios simultaneously.

Documentation:
Plott, B., Archer, S., White, D. “SMART Build 3 – A Simulation Tool for Accessing Job Skill Requirements,” Advanced Simulation Technologies Conference Proceedings, April 2002.

White, D., Archer, S., and Nugent, W. “Manpower Modeling and Simulation for 21st Century Platforms,” Proceedings of Knowledge Warfare: Making the Human Part of the System, Human Systems Integration Symposium, 5-6 November, 2001.

Schunk, D. and Archer, S. “Evaluating Workload Capabilities with the Ship Manpower Analysis and Requirements Tools (SMART),” Proceedings of the Military, Government, and Aerospace Simulation (MGA 2001) Conference, pg 39-43, editor Michael Chinni, 2001.

Plott, B. "SMART Build 3 Users Manual," 2003.

Stage of Development:
SMART version 1.0 is available from NSWCDD.

Date Current Version Released:
September 2003

Validation:
Preliminary verification was done on the maintenance modeling portion of SMART with NACMAC personnel.

Comments:
SMART was developed by Micro Analysis and Design, Inc. (www.maad.com)

SMART uses the skill and ability taxonomy of Dr. Edwin Fleishman.

The Micro Saint discrete event simulation engine is used.

How To Acquire:
Contact POC listed above.

Title: Situation Awareness Global Assessment Technique (SAGAT)

Overall Category: Tool
Update: August 2004

Owner/Sponsor Organization: SA Technologies, Inc.
http://www.SAtechnologies.com/

Point of Contact Information:

Dr. Mica Endsley
770-565-9859 FAX: 770-579-1132
Mica@SAtechnologies.com

General Overview:

The Situation Awareness Global Assessment Technique (SAGAT) provides an objective measure of situation awareness by directly comparing operators' reported SA to reality. With this technique, a human-in-the-loop simulation is frozen at randomly selected times, the simulation is suspended, and the system displays are blanked while the operators quickly answers questions about their current understanding of the situation. Operators' perceptions are then compared to the real situation (based on information drawn from the computer or from subject matter experts who answer the SAGAT queries while looking at the displays). Comparing the data in this manner provides an objective, unbiased assessment of SA.

In order to provide an accurate measure of the operator's SA, SAGAT queries must cover all levels of SA (i.e., perception, comprehension, and projection issues) and must be reflective of a wide range of the operators' SA requirements. These SA requirements are delineated through a goal-directed task analysis, which identifies the operators' goals, the decisions the operators must make to achieve these goals, and the information the operators need to make the decisions. These information requirements are the operators SA requirements and they form the basis for the development of the SAGAT queries.

SAGAT is a particularly useful tool in design evaluation because it provides diagnostic information regarding how well the system in question supports the operator's various SA requirements. SAGAT results provide diagnostic information that indicate ways in which a given design concept improves SA and ways in which it worsens SA. These results can then be used to refine the design concepts. For example, finding queries that are frequently answered incorrectly can give the designer insight into areas where the operator's SA needs are not being supported. Thus, the designer has specific guidance as to ways to improve the interface design in order to better support the operator's SA. This type of specific tailored information aids the designer in building system concepts that support high levels of SA.

Equipment/Software Required:

In general, SAGAT is administered via a computer to ease administration and scoring of data, although it may also be administered via paper and pencil.

Documentation:

Endsley, M. R. (1995). Measurement of Situation Awareness in Dynamic Systems. "Human Factors," 37(1), 65-84.

Endsley, M. R. (2000). Direct measurement of situation awareness: Validity and use of SAGAT. In M. R. Endsley & D. J. Garland (Eds.), "Situation Awareness Analysis and Measurement" (pp. 147-173). Mahwah: Lawrence Erlbaum Associates.

Endsley, M.R., Bolte, B., & Jones, D. G. (2003). "Designing for situation awareness: An approach to user-centered design." London: Taylor and Francis.

Endsley, M. R., & Boldstad, C. A. (1994). Individual differences in pilot situation awareness. "International Journal of Aviation Psychology," 4(3), 241-264.

Endsley, M. R., & Kiris, E. O. (1995). Situation awareness global assessment technique (SAGAT) TRACON air traffic control version user's guide. Lubbock: Texas Tech University.

Endsley, M. R., Sollenberger, R., Nakata, A., & Stein, E. (2000). "Situation awareness in air traffic control: Enhanced displays for advanced operations" (DOT/FAA/CT-TN00/01). Atlantic City: Federal Aviation Administration William J. Hughes Technical Center.

Kaber, D. B., Endsley, M. R., Wright, M. C., & Warren, H. L. (2002). "The effects of levels of automation on performance, situation awareness, and workload in an advanced commercial aircraft flight simulation" (Grant #NAG-1-01002). Hampton: NASA Langley Research Center.

Kaber, D. B., Onal, E. and Endsley, M. R. (2000). Design of automation for telerobots and the effect on performance, operator situation awareness and subjective workload. "Human Factors & Ergonomics in Manufacturing," 10(4), 409-430.

Matthews, M. D., Pleban, R. J., Endsley, M. R., & Strater, L. G. (2000). Measures of infantry situation awareness for a virtual MOUT environment. In D. B. Kaber & M. R. Endsley (Eds.), "Human Performance, Situation Awareness, and Automation: User-centered Design for the New Millennium." Atlanta: SA Technologies, Inc.

Stage of Development:
Guidance for developing and implementing SAGAT can be found in the references listed in the DOCUMENTATION section. Computerized versions of SAGAT are currently available for several domains (e.g., air traffic control and commercial aviation). *SuperSAGAT*, a computerized tool that allows users to customize SAGAT, is available at www.SAtechnologies.com.

Validation:
Numerous studies have been performed to assess the validity of SAGAT (e.g., Endsley, 1995). SAGAT has been shown to have a high degree of reliability (e.g., Endsley & Boldstad (1994)), to possess sensitivity to condition manipulations (Endsley, 2000), and to be effective across a variety of domains, including air traffic control (Endsley, Sollenberger, Nakata, & Stein, 2000); infantry operations (Matthews, Pleban, Endsley, & Strater, 2000); commercial aviation (Endsley & Kiris, 1995; Kaber, Endsley, Wright, & Warren, 2002); and teleoperations (Kaber, Onal & Endsley, 2000; Kaber, Wright, & Hughes, 2002). (See references in DOCUMENTATION section.)

How To Acquire:
Contact POC listed above or visit www.SAtechnologies.com.

Title: SURVEYWin / EZSurvey

Overall Category: Tool
Updated: July 2004

Owner/Sponsor Organization: Raosoft, Inc.
http://www.raosoft.com/

Point of Contact Information:
Ms. Catherine McDole Rao
206-525-4025 FAX: 206-525-4025
raosoft@raosoft.com

Product Specific Web Site:
http://www.raosoft.com/products/

General Overview:
Raosoft, Inc., develops and sells software for the design of electronic forms, data collection and analysis, and reports. The programs, EZSurvey for the Internet, SURVEYWin, and InterForm, are the authoring software, where EZReport and RapidReport both provide additional reporting power. The software provides specialized power for questionnaire-type forms, for applications such as evaluations, assessments, profiles, employee reviews, and customer satisfaction, plus factual data collection. Non-experts, as well as experts, can design forms with powerful data validation options. InterForm is the new advanced Web application developer. It has been used successfully for the Chief of Staff of the Air Force Command Climate and Quality of Life Survey for World Wide Web collection project for 500 questions and more than 500,000 participants. Both EZSurvey and InterForm provide for numerous data gathering projects for the military and federal government, as well as for corporate organizations. This is a robust database management system.

Uses include assessments, training evaluations and other types of evaluations, profiles, customer satisfaction, employee reviews, and more. For factual data collection, the software has been used for collecting pricing information, inventory of items, computer security status, and is appropriate for almost any other data collection project.

Data collected can be analyzed, and customized reports made, with Raosoft EZReport and RapidReport; or, the data can be exported to standard databases for use with ongoing work operations.

Equipment/Software Required:
PC for authoring, Windows NT, UNIX, any standard Web server.

Input/Output/Processing:
For SURVEYWin authoring, no particular computer expertise is needed. For the Internet form designers, a Web-knowledgeable person is needed for posting the forms.

The data is collected electronically over LAN, standard e-mail attachment, diskette, file, Web posting, Internet e-mail, as well as "kiosk"-type and notebook entry.

Data is collected in standard DB format with import/export in ASCII with full choice of delimiter type.

Documentation:
Full documentation comes with all software, with online Help and separate user’s manuals.

Stage of Development:

All Raosoft software is fully functional. The database is robust, and has been in use with the Federal Government and military since 1991.

Date Current Version Released:
March 2004

Validation:
Validation options are available in the software form design to allow accurate data collection and greater ease of use.

Comments:
Raosoft, Inc., offers special programming assistance to put together the various Raosoft software modules for custom applications. Contact Raosoft, Inc., for discussion of particular applications or visit the web site to view the Research and Development page.

How To Acquire:
Point of Contact listed above. Please visit the Raosoft, Inc. web site or send email

Title: Task Analysis Workload (TAWL)

Overall Category: Tool
Update: February 2005

Owner/Sponsor Organization: Army Research Institute for the Behavioral and Social Sciences
http://www.hqda.army.mil/ari/

Point of Contact Information:

Dr. William Howse
334-255-3686 DSN: 558-3686 FAX: 334-255-9025
william.howse@rucker.army.mil

General Overview:

TAWL uses task analysis information to develop operator workload prediction models, i.e., estimates of the workload associated with the cognitive, psychomotor, and sensory components of individual and concurrent operator tasks. TAWL can be used with a variety of databases, such as the TAWL Operation Simulation System (TOSS). (TOSS is a database for aircraft which includes the UH60, AH64, CH47, MH47, and MH60.)

With the TOSS database, TAWL can be used to determine the optimal system design or configuration for a mission based on workload considerations, develop models of two or more systems to identify the systems or configurations with higher workload, and evaluate a system's manning and training requirements.

The output from TAWL can be used to identify mission time periods, components, crewmembers, and subsystems with high workload. This information can be used in the system design process, e.g., to make adjustments in the distribution of tasks during the mission to equalize workload over time and over crewmembers, or to make adjustments in the nature of tasks.

Equipment/Software Required:

The equipment required to use TAWL consists of an IBM-compatible computer and keyboard with 640K of memory on a DOS operating system version 2.0 or greater. A hard disk drive and a printer are recommended.

Input/Output Processing:

The inputs required to use TAWL include: (1) task analysis data (mission phases, segments, functions, and tasks; person(s) performing each task; subsystem(s) associated with each task; and estimates of the duration of each task); (2) task workload ratings; (3) function and segment decision rules; and (4) overload thresholds.

Processing capabilities include model execution and simulation (with optional randomization of tasks and functions), computation of workload metrics, and file handling of all model input and output.

The TAWL output consists of workload metrics (number of overload conditions, number of component overloads, and overload density) for segments and crewmembers, summary of subsystem overloads, and task listings. Analyses can be made for up to four crewmembers.

Documentation:

Bierbaum, C.R., Fulford, L.A., and Hamilton, D.B., "Task Analysis/Workload (TAWL) User's Guide (Draft Research Product for ARI)," Ft. Rucker, AL: Anacapa Sciences, Inc., 10-89.

Iavecchia, H.P., Linton, P.M., Bittner, A.C. Jr, and Byers, J.C., "Operator Workload in the UH-60A Black Hawk: Crew Results VS. TAWL Model Predictions," Proceedings of the Human Factors Society, 33rd Annual Meeting, Santa Monica, CA: Human Factors Society, 1989.

Alternative/Comparable Approaches:

Computer-Aided Function Allocation Evaluation System (CAFES): Workload Assessment Model (WAM). Wright-Patterson AFB, OH: Aerospace Medical Research Laboratories, Human Engineering Procedures Guide (AFAMRL-TR-81-35).

Stage of Development:
Completed.

Comments:
TOSS is menu-driven. It provides workload estimates for up to six workload Components.

How To Acquire:
Point of Contact listed above.

Title: Tribus Process Analysis

Overall Category: Tool
Update: August 2005

Owner/Sponsor Organization: Naval Air Warfare Center - Weapons Div (NAWCWPNS)

Point of Contact Information:

Ms. Gene Schneider
House of Hrair
760-384-8532
gschneider@iwvisp.com

General Overview:

This method uses the Tribus "deployment" flowcharting technique to document work processes. The Tribus charts look a lot like software flowcharts, in terms of the symbology used. Certain aspects of the charts, however, make this method powerful for documenting processing:

1. There is a heading across the top of each chart that tells functional "agents" responsible for performing the activity implied by each symbol, and other agents who take part in or provide support for the activity.
2. Each chart is required to be only one page long, so everything you need to know to understand the chart is on that page.
3. Subprocesses within processes are designated by a special symbol that means there is another whole chart that gives details of the process underlying that task name.

The overall method encompasses processes of its own, involving:

1. Starting a task team to analyze and document processes.
2. Running and recording results of task team meetings.
3. Communicating progress to the task team.
4. Designing and developing the charts themselves.
5. Writing the background documentation for each chart.
6. Performing CM and change control on the charts.
7. Distributing new and updated charts.

The method can be used in any situation that requires documenting work processes. These charts are useful as "division markers" in Procedure Manuals. Generally, the charts stop at a level of detail just above that of step-by-step desk procedures.

The main use of the charts is to make sure everyone on a project team understands: 1) what activities must be done during each project phase; 2) in what order things are done; 3) who is responsible for accomplishing each activity; and 4) what dependencies exist between activities and the agents who perform them. The charts are also used to design schedule and resource templates for project planning. To a lesser extent, they are used to track project progress.

In the future, more exacting use will be made of the chart: each activity, and each functional agent who works on it, will be assigned to a unique place in a MIL-STD Work Breakdown Structure (WBS); If this turns out to be effective, actual project costs can be linked to the WBS. This information can be used to improve project planning and estimating techniques, and to refine our understanding (and documentation) of the work processes themselves.

Equipment/Software Required:

This method does not really require use of computers. The current implementation runs on Macintosh. We use:

1. Word for documents, team letters, etc.
2. MacDraw Pro for the final, distributable charts.

3. FileMaker Pro for the Process Change Request database.
4. QuickMail for distributing memos, etc., electronically.

Input/Output Processing:
None (unless task team meetings are considered a Processing Technique).

A book containing: 1) process charts; 2) background information on how to read the charts; and 3) the Process Change Request form and instructions for its use. As they become available, it will also contain "MiniSpecs" describing each chart (its purpose, relationship to other charts, and a short definition of each activity/symbol).

Documentation:
[Tribus doc.] "Putting TQM to Work," American Training Alliance, 1991. Tribus Process Analysis Engineer's Handbook (draft), NAWCWPNS (C2103), China Lake, CA, February 94.

Alternative/Comparable Approaches:
Entity Relationship Diagrams
Control/Data Flow Diagrams

Stage of Development:
The method is fully operational. Like all TQM methods, it is continuously being improved. Copies of the Tribus Process Analysis Engineer's Handbook are available on request from the POC.

Comments:
We are experimenting with a tool, called TeamFlow, that task teams might use to draft new or updated charts. Using TeamFlow, we can ignore the one-page constraint, both on activities (vertical) and agents (horizontal), while we are brainstorming. It also gives us much more ability to move objects. TeamFlow also provides a structure for defining agents and their relationships, and the "MiniSpecs" for each symbol that appears on the chart. Unfortunately, it doesn't allow us to use all the Tribus symbols, but we can live with it.

In a few charts, it was necessary to show when things happen on an annual cycle, so we added a column down the side with dates in it.

How To Acquire:
Point of Contact listed above.

Title: Usability Problem Inspector (UPI)

Overall Category: Tool
Updated: August 2004

Owner/Sponsor Organization: Air Force Research Laboratory
http://www.afrl.af.mil/

Point of Contact Information:

LtCol Terence S. Andre
US Air Force Academy
719-333-2972 DSN: 333-2972
terence.andre@usafa.af.mil

Product Specific Web Site:
http://hemlock.cs.vt.edu/publicuafviewer/pages/default.asp

General Overview:
The Usability Problem Inspector (UPI) is an inspection tool based on an organizing framework of usability concepts and issues. The UPI is intended to help inspectors conduct a highly focused inspection of a target application, resulting in a list of usability problems that users will potentially have with the application. The UPI brings together aspects of both the heuristic evaluation and the cognitive walkthrough. The UPI fits in between these two, capturing the ease of use of the heuristic evaluation, but also providing interaction-based structure from the cognitive walkthrough. As a Web-based tool, the UPI is easily adapted to various inspection conditions and goals by applying usability situation filters at the beginning of the inspection. The output from the UPI is a list of usability problems with database tags that further describe and classify each problem.

The default database contained in the UPI is designed for graphical user interfaces (GUI), although the database can be tailored for other applications, such as virtual environments, voice, and We-based interfaces. Usability experts, who need a tool to more clearly describe, classify, and record a usability problem will find the tool particularly useful. Although the questions in the UPI are designed for a relatively mature interface, the system can be easily tailored to inspect a system that is only in paper prototype form.

Used for the evaluation and redesign of the target interface application.

Equipment/Software Required:
The UPI is intended to be hosted on Windows 98, 2000, XP or NT computers with Microsoft Internet Information Service, Microsoft Access, and a Web browser (Netscape 4.0 or IE 4.0, or higher versions).

Input/Output Processing:
The inspector (user of the UPI) provides user class information, task descriptions, and interface description to the UPI at the beginning of the inspection session. These inputs are used by the UPI to produce a uniquequestion set for the inspector to analyze.

The UPI guides the inspector through a series of questions to discover potential problems with an interface. To generate a focused inspection, the inspector uses the UPI in either a task-based or free-exploration mode. Representative tasks are generally developed and provided by the development team, so that the inspector can "step through" important aspects of the design in a timely and efficient manner. In addition, the inspector also can use free-exploration as a way to further investigate specific attributes of the interface that were only briefly examined during the task-driven approach. For example, the inspector may have seen a dialog box during the task-driven approach that warrants further investigation. For the task part, the dialog box may not have generated usability problems, but the investigator may want to look at some of the specific attributes of the dialog box not related to any specific task other than user exploration.

The highly focused inspection produces a list of usability problems that users will potentially have with the system. Each problem is associated with one or more attributes from the database to help provide a more complete description of the problem.

Documentation:
Online help is provided within the tool.

Alternative/Comparable Approaches:
The Cognitive Walkthrough

Stage of Development:
Version 1.0

Comments:
For background on the UPI, see the Web site.

How To Acquire:
Point of Contact listed above, or:
Alternate POC:

Dr. H. Rex Hartson
Dept. of Computer Science
660 McBryde Hall
Virginia Tech (VPI&SU)
Blacksburg, VA 24061-0106
540-231-4857
hartson@vt.edu

Title: Web Guard Authentication

Overall Category: Tool
Updated: August 2004

Owner/Sponsor Organization: Defense Manpower Data Center
http://www.dmdc.osd.mil/

Point of Contact Information:
Mr. Matthew A. Torres
831-583-2400 x 5729 DSN: 878-2400 FAX: 831-583-2340
torresma@osd.pentagon.mil

General Overview:
Web Guard is an application that was developed by the Defense Manpower Data Center to restrict access to DoD web sites to members of the DoD community. DMDC compares information submitted against data in the DMDC Person Data Repository, which includes all DoD Active, Reserve, Civilian, Retired, etc. personnel and their dependents and is a real time system updated continuously. Access is given if the information matches the business rule set of the web site.

DoD Web sites and applications that use Web Guard will be able to use it every time a user logs in. This is to ensure that only users who are currently eligible based on DMDC Person Data Repository data and pre-specified qualification rules are granted access to a DoD Web site application.

Based on the return code, the DoD Web site or application can proceed accordingly with the prospective user.

Equipment/Software Required:
Web Guard can be implemented on ANY web platform - there is no specific hardware or operating system required. Basic Web Guard will work on sites with a digital certificate (SSL) and programming language capable of fetching SSL web pages. Web Guard Proxy Login will work on all other sites, whose programming language simply needs the ability to fetch a non-SSL page. The software must also support Session management-either using built-in session support (as in Microsoft IIS) or explicit coding - where session IDs are issued and tracked by your software application.

Input/Output Processing:
Require SSN, Date of Birth, and Last Name from potential users for authentication in Web Guard.

The personal data input by the user is submitted to Web Guard to determine if the user has a record in the DMDC Person Data Repository. The user is given access to the Web site or application if they are identified as having a record in the DMDC Person Data Repository and they meet any additional qualification rules established for that site.

A code will be returned to the Web site or application indicating whether or not the user has a DMDC Person Data Repository record and whether or not they meet any additional qualification rules established for the Web site or application.

Documentation:
"The DMDC Web Guard System" and "The DMDC Web Guard System Case Studies" available from DMDC Web Guard POC (above).

Stage of Development:
Current version: 2.73.001

Date Current Version Released:
March 5, 2003

Validation:
Web Guard is in production at DMDC and other DoD Web sites. Contact DMDC Web Guard POC for more information.

How To Acquire:
Point of Contact listed above.

Title: WebMetrics 3.0

Overall Category: Tool
Update: September 2004

Owner/Sponsor Organization: National Institute of Standards and Technology (NIST)
http://www.nist.gov/

Point of Contact Information:

Dr. Sharon J. Laskowski
310-975-4535 FAX: 310-975-5287
sharon.laskowski@nist.gov

Product Specific Web Site:
http://www.nist.gov/webmetrics/

General Overview:
The WebMetrics Tool Suite contains rapid, remote, and automated tools to help produce usable websites. The latest release is version 3.0.The latest release is version 3.0. No additional tools are planned for the future; however, we welcome your feedback on the existing tools.

Release 3.0 of WebMetrics contains:

The Web Static Analyzer Tool (WebSAT) (http://zing.ncscl.nist.gov/WebTools/WebCAT/overview.html) checks the HTML of web pages against usability guidelines, either its own, or a set of IEEE Std 2001-1999 guidelines. It can check individual pages or an entire website.

The Web Category Analysis Tool (WebCAT) (http://zing.ncsl.nist.gov/WebTools/WebCAT/overview.html) lets the usability engineer quickly construct and conduct a simple category analysis across the web. It is a variation upon traditional card sorting techniques. The usability engineer establishes a set of categories and a number of items which are to be assigned by test subjects to those categories. The engineer can then compare the actual assignments with the intended usage to make sure that the categories match users' intuitions.

The Web Variable Instrumenter Program (WebVIP) (http://zing.ncsl.nist.gov/WebTools/WebVIP/overview.html) lets the usability engineer rapidly instrument a website so as to capture a log of user behavior on the site. Once the site is instrumented, test subjects are asked to complete tasks typical of those for which the site is designed. Their interactions (such as navigating among pages and manipulating buttons and checkboxes) are captured in a log file for later analysis. Note that even remote users can be tested.

The Framework for Logging Usability Data (FLUD) (http://zing.ncls.nist.gov/WebTools/FLUD/overview.html) is a file format and an associated parser for representation of the behavior of website users. The captured log data can be valuable for analyzing and improving the usability of web-based applications. This log data is quite complex and therefore a common file format is needed to allow various components (such as recorders, parsers, analyzers, and visualizers) to exchange information.

The FLUDViz tool (http://zing.ncsl.nist.gov/WebTools/FLUDviz/overview.html) lets the usability engineer (UE) visualize and analyze a single usability session. The x-axis is used for time, and the y-axis for the types of behavior. The UE can zoom and pan in the time dimension by manipulating a time slider at the bottom of the display. The UE can also filter activity type in the Y dimension through the control menu.

The VisVIP tool lets the usability engineer visualize (in 3D graphics) and analyze the navigational paths of website users as captured in a FLUD file. VisVIP automatically lays out a 2D graph of the website, and then

overlays the paths of selected subjects to show which pages were visited. A vertical bar indicates how much time users spent at the various pages. (http://zing.ncsl.nist.gov/WebTools/VisVIP/overview.html)) and analyze the navigational paths of website users as captured in a FLUD file. Vis VIP automatically lays out a 2-D graph of the website, and then overlays the paths of selected subjects to show which pages were visited. A vertical bar indicates how much time users spent at the various pages.

The TreeDec tool (http://zingl.ncsl.nist.gov/WebTools/TreeDec/overview.html) supports the representation of a website as a single logical tree. It automatically adds links (such as so-called "breadcrumbs") to each page of the website to allow easy navigation to nearby nodes of the tree.

Remotely test and analyze the usability of websites.

WebSAT identifies potential usability problems which should be investigated further through user testing. WebCAT lets the usability engineer quickly construct and conduct a simple category analysis across the web. WebVIP lets the usability engineer rapidly instrument a website for local or remote testing by employing visual instrumenting, as well as automated, techniques.

Equipment/Software Required:
Any platform running Windows 95, Windows 98, Windows NT, or Unix; for WebVIP, you must install software that can copy a website.

Input/Output Processing:
Depends on the tool: WebSAT takes a URL as input; WebCAT takes baseline categories of information from the usability engineer, and then input from users; WebVIP takes a website as input, and then logs user navigation paths.

Depends on the tool: WebSAT identifies potential usability problems; WebCAT produces a comparison of user categories vs. the baseline; and WebVIP produces logs of user paths.

Documentation:
Online at the web site.

Alternative/Comparable Approaches:
Standard usability engineering techniques.

Stage of Development:
This is the first prototype. We are adding new features and visualizations of user logs based on user feedback.

Validation:
Currently undergoing evaluation.

Comments:
Direct all comments and questions to: webmetrics@nist.gov. If you are using our tools, please contact us about participating in the collection of case study data to help validate our tools.

How To Acquire:
Point of Contact listed above.

Title: WinCrew

Overall Category: Tool
Updated: August 2004

Owner/Sponsor Organization: Micro Analysis and Design, Inc
http://www.maad.com/

Point of Contact Information:

Ms. Wendy Bloechle
303-442-6947 FAX: 303-442-8274
wbloechle@maad.com

Product Specific Web Site:
http://www.maad.com/index.pl/wincrew

General Overview:
WinCrew is a task and workload analysis tool. It predicts system performance as a function of human performance. It models behaviors in response to workload levels which may affect performance.

WinCrew predicts and assesses changes in system performance as a result of varying function allocation, number of operators or crew, level of automation, task design, mode of information presentation, and response to high workload. Through iterative use, determine high drivers affecting human and system performance. WinCrew has been used to investigate options for reduced manning, effects of different levels of automation, and workload imposed on human operators by system design concepts.

Analyst qualifications: A background in operations research analysis is helpful. Tool users must understand basic task analysis methods and workload concepts. A Bachelor's degree in an HFE-related field is usually sufficient. The training course offered by Micro Analysis and Design is highly recommended.

Equipment/Software Required:
Microsoft Windows 95, 98, NT 4.0, 2000, or XP; 32 MB of RAM minimum; 25 MB hard drive; CD-ROM drive for installation.

Input/Output Processing:
Functions, function sequences, task times and sequences, initial operator assignment to tasks, consequences of error, automation concept (function allocation), crewstation design concept (as it affects mental resources used to perform tasks), and workload associated with tasks.

Standard task analysis data collection forms, questionnaires, etc., are used. Task times and some sequencing information come from field data, estimates from algorithms/lab studies (some available as 'micromodels' in the software), and estimates from subject matter experts. Operator task assignment, task sequencing, automation concept (function allocation), crewstation design concept (as it affects mental resources used to perform tasks), and workload associated with tasks are all derived from the system designers' concept of how the system will be used and how the human operators will perform necessary tasks.

Stochastic network modeling is used to aggregate individual estimates made at the task level up to the system level. After all data input is complete, the user selects a random number seed and executes the model in either 'silent' or 'animation' mode. Animation mode highlights the tasks as they are being executed in the simulation. The tool facilitates sensitivity analysis to determine high drivers for system performance.

The following preformatted reports are produced by WinCrew as a result of model execution:

- Mission Summary
  - Critical Path Summary
  - Task Summary
  - Operator Activity
  - Operator Workload
  - Overload
  - Channel Conflict
  - Task Timeline
  - Crewstation Workload
  - Read User Snapshot

Alternative/Comparable Approaches:
IMPRINT or IPME.

Stage of Development:
WinCrew Version 3.59 is in distribution, and is being used by various Government agencies and the private sector. WinCrew does not have a regular maintenance program. Most WinCrew users in the U.S. are now using IMPRINT.

Date Current Version Released:
Version 3.59 was release in April of 2002.

Comments:
WinCrew is the updated Windows version of the CREWCUT (UNIX-based) workload analysis tool. CREWCUT is no longer available and has been superceded by WinCrew.

WinCrew is free to DoD employees only.

How To Acquire:
Point of Contact listed above or e-mail sales@maad.com.

The Web Static Analyzer Tool (WebSAT) checks the HTML of web pages against usability guidelines, either its own, or a set of IEEE Std 2001-1999 guidelines. It can check indi